THE IRON TRADE REVIEW

VOLUME XXX. CLEVELAND, O. NOVEMBER 4, 1897. CHICAGO, ILL. NUMBER 44

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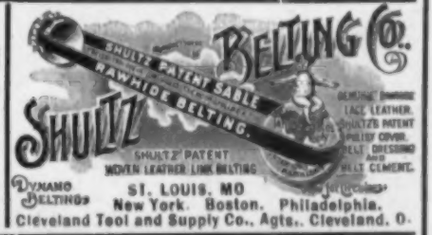

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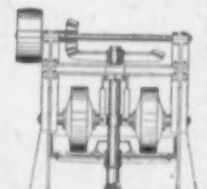
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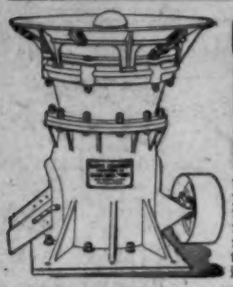

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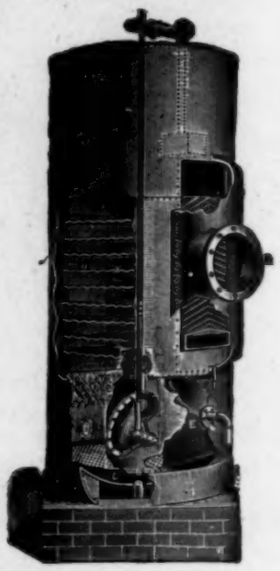

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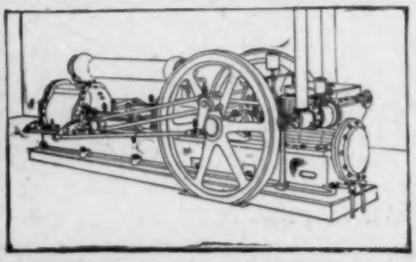

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THE IRON TRADE REVIEW

VOLUME XXX. CLEVELAND, O. NOVEMBER 4, 1897. CHICAGO, ILL. NUMBER 44

THE WEEK IN IRON CIRCLES.

THE MARKET AT LARGE.

Neither in sentiment nor in the volume of business has there been any noteworthy change in iron the past week. The wait for developments concerning 1898 continues and with good reason, and meantime the heavy mill tonnages keep up. There is a slightly weaker market in Bessemer and on bars and structural material the mills are not so well supplied with orders as in the past two months. As the new year comes nearer there is a general canvassing of probabilities as to the continuance of the heavy consumption which has been going on since the revival that set in in August. The railroad statements for September are an index to the most important factor in the whole situation. For the grain-carrying lines the record of that month was in some cases without parallel, the statements of earnings showing a prodigious advance over recent years and indicating that the return of dividend-paying is at hand for lines that have had a struggle to pay fixed charges in years of depression. Track-laying and rolling stock replacement are rightly counted on as a large element in demand for the new year. The history of such movements has always been that the iron trade follows by some months in reaping the benefits that come to farmers and railroads from heavy and remunerative crops. Some car-buying is reported from Chicago in the past week and further contracts are being figured on, the new business in sight amounting to about 6,000 cars. The rail situation has not developed as yet and the mills seem disposed to postpone the issue until a few more points are fixed as to raw material costs. The probable increases in coke, ore and labor might make a difference of $1.50 a ton in the cost of the finished product, which means a very moderate increment on any single element. It is good demonstration of the fine margins to which iron and steel have come, that the trade halts pending decisions on advances that only a short time back would scarcely have figured as incidents. In the past week there has been but little buying of Bessemer iron, but $9.65 to $9.75, valley furnace for 1897 delivery fairly represents the market, while speculative Bessemer has been offered in Cleveland at $10.25, delivered. Billets are quoted $16.50, Pittsburg maker's mill, and in the East at $18.50, Philadelphia, the latter being about 25 cents below last week's figures. The failure to make deliveries of sheet bars is strongly felt in tin plates and sheets and for prompt sheet bars higher figures are made—$18.50, Pittsburg, in some cases. The Southern foundry irons hold firmly. Production is at the maximum until ore and coke supplies can be increased, of which there is no probability. Stocks continue to decrease and several thousand tons of warrants have been taken up in addition.

THE CLEVELAND DISTRICT.

So well sold are old-range Bessemer ores that it is doubtful if a total of 200,000 tons could be scraped up at the end of the season, counting 1896 dock ores and all. The sales of old-range Bessemers for the year and of other old-range ores entering Bessemer mixtures will be fully 6,000,000 tons. Some facts relative to the present rate of consumption of Lake Superior ores are presented elsewhere in this issue. The figures for October shipments are not yet made up, but it is not out of the way, from present indications, to count on a total by water for the season, of nearly 11,500,000 tons. Shipments in November will be light. Four large shippers have a total of less than 200,000 tons to come. Ore cargoes are scarce and vessel rates have remained unchanged, coal having to stand some advance on account of the smaller chance of getting cargoes down.

Pig Iron. Some of the speculative iron that has been a market factor of late has been offered at $10.25, Cleveland. Valley iron for delivery this year can be had close to the corresponding figure, or $9.60, though little is wanted and transactions are few. In the latter part of last week $9.75 was done, and one sale was made at $9.72, valley. The coke price for 1898 seems likely to be an uncertainty for some weeks yet and meantime buying and selling of iron will be restricted within rather narrow limits. There is still a chance that some December iron will be taken by Pittsburg steel works, but the finished material demand has slackened in a way that may make the expected purchases unnecessary. Foundry irons are quieter, with prices in some quarters a shade easier for 1897 shipment. Forge iron is quoted at $9 to $9.10, in the valley, with little doing. In Lake Superior charcoal there has been some activity in view of the approaching close of the season of navigation. We quote Cleveland deliveries:

Bessemer	10 25@10 50	Valley Scotch No. 1	$11 15@11 40
No. 1 Strong Foundry	11 15@11 25	Valley Scotch No. 2	10 65@10 90
No. 2 Strong Foundry	10 65@10 75	Gray Forge	9 65@ 9 90
No. 3 Foundry	10 00@10 25	Lake Superior Charcoal	12 25@12 50

Finished Material. A generally quieter market is noticed in finished lines, though local mills are running to their fullest capacity. In the Mahoning valley there is the same experience—customers pressing for deliveries, while the new business coming in is not up to the tonnage turned out. Prices are unchanged, though bars are a trifle weaker. We quote 1.05c on bar iron in car load lots and 1.08½ for steel; tank plates, 1.15c; beams and channels, 1.10c to 1.15c; No. 28 sheets, 2.15c. Wire and wire nail mills are exceedingly busy. Nails for early shipment are a shade lower with some sellers, and $1.45 to $1.50 is the market on carload lots. Wire remains at $1.20. Wire rods for 1897 shipment are in demand. A sale of 2,000 tons delivered at a Northern Ohio point was made at $23.50. Business in old material has fallen off somewhat and prices of a week ago can be shaded. We quote $14.50 for old iron rails; $10.50 to $10.75 for old steel rails; $11.75 to $12 for No. 1 wrought scrap.

CHICAGO.

OFFICE OF *The Iron Trade Review*
1142 MONADNOCK BLOCK, Nov. 3.

By far the larger part of the business placed last week originated with the railroads. The car builders of this part of the country have secured a number of orders, and other orders are in the market and will be placed soon. Over 3,000 cars were bought last week, and inquiries in the market will foot up at least 3,000 more. Some of the material for these has already been bought, and the balance will come upon the market very soon. Business otherwise has been light, and very few orders of any magnitude have been placed, for any class of material. Dealers do not expect any large business in the balance of this year, as the buyers generally appear to have filled their requirements, or nearly so, up to Jan. 1, and the mills and furnaces all have order books well filled for the same period. The market, generally speaking, is very firm, and no changes are made in any quotations.

PIG IRON.—Last week was quiet. The largest order probably did not exceed 500 tons. Buyers are not expected to come into the market for any very large quantities for delivery in the balance of this year, as most of them have fully satisfied their requirements for that time. The furnaces are not pushing sales beyond the first of the year, and where they are made for delivery after Jan. 1, it is with an effort to secure an advance of 25 cents a ton over present quotations. The situation is very strong, and sellers entertain no idea that prices will be at all lower than they are at present The largest Southern producer has at present the smallest stocks of iron that it has had for a long time past. Oct. 20 the stock was reported to be 52,000 tons, a decrease in two months of 62.000 tons. At the same time the furnaces were delivering all the iron they were making, and the deliveries were only limited by the number of cars they could secure.

Lake Sup. Charcoal	$12 50@13 00	South'n Coke No. 3	$10 35@10 60
Local Coke Fdy. No. 1	11 50@12 00	Southern No. 1 Soft	11 00@11 25
Local Coke Fdy. No. 2	11 00@11 50	Southern No. 2 Soft	10 60@10 85
Local Coke Fdy. No. 3	10 50@11 00	South'n Silveries	11 25@11 50
Local Scotch Fdy. No. 1	11 50@12 00	Jackson Co. Silveries	12 50@14 50
Local Scotch Fdy. No. 2	11 00@11 50	Ohio Strong Softeners	12 00@12 25
Local Scotch Fdy. No. 3	10 50@11 00	Alabama Car Wheel	16 00@17 00
South'n Coke No. 1	11 00@11 25	Malleable Bessemer	10 75@11 00
South'n Coke No. 2	10 60@10 85	Coke Bessemer	11 50@12 00

BARS.—Car builders continue to be the principal buyers of bars, but sales to this class of customer were not especially large last week. No very large contracts were closed. The market is very firm, and prices are unchanged at 1.15c to 1.20c for common iron, 1.20c to 1.25c for soft steel bars from strictly billet stock, and 1.20c to 1.25c for guaranteed iron. The mills of the Springfield Iron Co. will be started up this month, probably about the 22nd.

CAR ORDERS.—Several good sized orders were placed last week, including among them, being an order for 300 cars, placed by the Iowa Central; one for 300 cars, placed by the Chicago Great Western; one for 450 cars, placed by the Ann Arbor; and one for 2,000 cars, placed by some road not named. All of these were given to Western car works. There are orders for at least 3,000 cars in the market now, among them being one from the Kansas City, Pittsburg & Gulf for from 200 to 400; one from the Duluth & Iron Range, for 300; one from the Seaboard Air Line for 650; one from the Norfolk & Western for 500; one from the Quincy, Omaha & Kansas City for 450; and one from Nelson Morris & Co., for 300.

RAILS AND TRACK SUPPLIES.—Business last week was limited to orders for light sections, this class of trade being very good. There are some inquiries for heavy sections, some of them for large lots, but the mills are not pushing for business at present, and are not as yet making prices for delivery next year. Prices are as follows: Rails, $20.50 to $22.50, according to specifications; steel splice bars, 1.20c to 1.30c; track bolts, with square nuts, 1.80c to 1.90c; hexagon nuts, 1.90c to 2c; spikes, 1.60c to 1.65c.

BILLETS AND RODS.—The local mills did no business in either billets or rods last week. The market is unchanged, and is nominal at $18 to $18.50 for billets, and $25 to $25.50 for rods.

STRUCTURAL MATERIAL.—No large contracts were placed last week, and no especially large new business has come up. A good many projects that have been on the market for some time are hanging fire, and some of these may be placed within a short time. Quotations are made as follows: Beams, 15-inch and under, 1.30c to 1.35c; 18, 20 and 24-inch, 1.40c to 1.45c; angles, 1.20c to 1.25c; plates, 1.30c to 1.35c; tees, 1.30c to 1.40c. Small lots from stock are quoted at one-quarter to one-half cent higher.

PLATES.—An unusual order was placed last week, calling for 200 tons of flange steel. This is larger than orders for this material usually run. Generally speaking, business was light, and included no large orders. Quotations are as follows: Tank steel, 1.30c to 1.35c; flange steel, 1.40c to 1.45c; fire box steel, 1.85c to 5c.

SHEETS.—There is a good demand for some grades, but others are in smaller request, and sales have not been especially large. Most of the business closed last week was in small lots. Quotations are made at 2.20c to 2.25c for No. 27 black, and 80 and 5 to 80 and ½ per cent discount for galvanized.

MERCHANT STEEL.—The demand is fully as large as it was a week ago, but the mills are not anxious for business and are not pushing sales; consequently the tonnage closed was not very large. Quotations are very firm, and in some cases are made higher than those we give: Open-hearth spring, tire and machinery steel, 1.65c to 1.75c; smooth finished machinery steel, 1.60c to 1.65c; smooth finished tire, 1.45c to 1.50c; tool steel, 5.50c to 7.50c; specials, 11c and upwards.

SCRAP.—There is only a comparatively small demand for scrap and sales are not so large as they were two weeks ago.

There are reports that some descriptions can be bought for lower prices than those we give, but they could not be verified, and we do not change our quotations. Dealer's selling prices are as follows:

Old iron rails, gross	$12 75@$13 25	Axles, net	$14 00@$14 25
Old steel rails, long, gr.	10 50@ 11 00	Cast borings, net	4 00@ 4 25
Old steel rails, short	9 00@ 9 50	Wrought turnings, net	5 50@ 6 00
Old wheels, gross	11 00@ 11 25	Axle turnings, net	7 25@ 7 50
Railroad forge, net	11 75@ 12 25	Mixed steel, gross	7 00
Dealer's forge, net	10 00@ 10 50	Stove plates, net	6 00@ 6 25
No. 1 mill, net	8 00@ 8 50	Heavy melting steel, gr.	8 00@ 8 25
Heavy cast, net	7 75@ 8 25	Old iron splice b., net	13 50@ 14 00
Malleable cast, net	9 00@ 9 25		

PITTSBURG.

OFFICE OF *The Iron Trade Review*,
807 TRADESMEN'S BUILDING, Nov. 3.

Tardy deliveries of billets and sheet bars are holding firm some finished lines and in black sheets are causing famine prices. In other instances demand for finished material has receded to about mill capacity, easing prices a little. Bars are notably weaker. Pig iron is inactive and foundry irons weakened during the week. The car scarcity is bothering both furnaces and steel works.

PIG IRON.—Another quiet week in Bessemer iron strengthens the opinion that but little buying remains to be done to cover this year's wants. There are few inquiries for iron except for next year and these do not receive much attention, and furnaces generally refusing still to commit themselves. Bessemer is quoted nominally at $9.75, valley, and $10 50, Pittsburg. Gray forge from second hands sold at $9.65, Pittsburg, early in the week, furnaces quoting $9.75 on the same lot and showing indifference regarding sales. Foundry grades weakened last week. A sale of No. 2 is reported at $10.35, which is about the market. Quotations are made as follows:

Bessemer, valley	$ 9.65 to $ 9.75
Bessemer delivered Pittsburg District	10.35 to 10.50
No. 1 Foundry	10.85 to 11.00
No. 2 Foundry	10.35 to 10.50
No. 3 Foundry	10.00 to 10.25
Gray Forge, Pittsburg	9 65 to 9.75

BILLETS, SHEETS, BARS AND RODS.—A scarcity of cars has increased the general inability to get steel as ordered, and good prices have been paid for prompt steel—$16.50 being given in several instances for billets. Sales of prompt steel to cover shortages have been made from Pittsburg to points west of the Mississippi River. Certain valley and Pittsburg mills are now making September deliveries of sheet bars and rods and see little improvement ahead. Sheet bar and rod orders for immediate use are bringing higher prices, $18 to $18.50 being secured for the former and $23.50 to $24 for the latter. Billets for future delivery are quoted at $16 to $16.25, maker's mill.

FERRO-MANGANESE.—Domestic ferro-manganese is higher, local quotations for 80 per cent being $47.50 and $48 delivered, Pittsburg district.

PLATES.—October orders of plates were ahead of the preceding month and much in excess of October, 1896. New business has dropped off of late, but mills are still behind orders. Mill quotations are: Bessemer and open hearth tank, 1.10c; shell, 1.15c; flange, 1.20c.

STRUCTURAL MATERIAL.—The fall season is noticed by both local structural mills in a decrease in large work. For the three Bessemer Steamship Co. boats, both plates and shapes were awarded the leading local interest through Detroit. The total will probably be close to 10,000 tons. The New York underground work is still pending. Small business is of good proportions and has decreased but little in the general lull of finished material. Mill quotations follows: Beams, 15 inches and under, 1.10c; 18 inches to 24 inches, 1.20c; tees, 1.20c; zees, 1.10c; angles, 1.10c; and universal plates, 1.05c to 1.10c.

BARS.—Both iron and steel bars have weakened and 1c is again possible on steel bars in fair quantities. For common bar iron, 1.05c is quoted in the valley and 1.10c, Pittsburg. Deliveries are in better shape few mills being now behind either on steel or iron. All-muck bar iron of branded grades is fairly strong and is quoted at 1.25c to 1.35c.

RAILROAD AND TRACK MATERIAL.—The local mill is full for this year and is not eager to quote for beyond January. Standard sections of T-rails are quoted as $20 at Bessemer. For 60-lb. relaying stock $15.50 to $15.75 is asked. On track material we quote: Iron track bolts, 1.65c to 1.70c; steel spikes, 1.45c to 1.55c; splice bars, 1.10c to 1.15c; links and pins, 1.15c to 1.20c.

SHEETS.—The sheet bar scarcity is annoying almost all sheet mills and the situation has not eased perceptibly yet. The effect on finished sheets is seen in 2.25c offered for No. 28 black sheets, November delivery and 2.15 offered for delivery in December. The association schedule is in force on heavier guages and nominally so on lighter grades as follows: No. 26, 2c; No. 27, 2.05c; No. 28, 2.10c. Galvanized sheets are held at 80 and 2½ per cent off list and black sheets for tinning at $2.20 and $2.25.

IRON AND STEEL SKELP.—Skelp deliveries are badly delayed and stocks available now are worth 25 per cent more than average market values. Quotations are made as follows: Grooved iron skelp, 1.15c to 1.17½c; sheared iron skelp, 1.27½c to 1.30c; grooved steel skelp, 1.02½c to 1.05c; sheared steel skelp, 1.10c to 1.12½c.

PIPES AND TUBES.—The demand for boiler tubes is undiminished and is out of all proportion to pipe in general. Merchant pipe demands are steady and the larger mills are filled on some sizes for the next four weeks. One interest has had to refuse business in the last week. Discounts are not so much of a consideration as delivery. Mills are quoting: But weld black, 72 per cent off; lap weld black, 78 per cent off; butt weld galvanized, 67 per cent off; lap weld galvanized, 70 per cent off. The second discount is 10 per cent on car load lots. Discounts on merchant boiler tubes are as follows: 2¼-inch and smaller, 72½ per cent off; 2½-inch and larger, 75 per cent off

OLD MATERIAL.—Scrap is noticeably inactive after the recent sales. Values have dropped correspondingly, the decline being more apparent in the lines recently higher. Old iron rails are quoted at $14 and $14.50; old steel rails, $10.50 to $11; No. 1 wrought, $12.50, net; cast scrap, $9 to $9.25, gross and car wheels at $11.

IN OTHER MARKETS.

[SPECIALLY REPORTED FOR THE IRON TRADE REVIEW.]

Cincinnati. Consumption is going on at a healthy rate, and stocks of iron at furnaces are decreasing and would run down still faster were it possible to get cars. Some of the Southern furnaces are thousands of tons behind their orders, because of scarcity of certain grades and the car famine. In view of the heavy buying movement during September and early October, it would not be surprising if a period of quiet should extend through November. The conditions of the market are normal, and the warrants offered are gradually being absorbed and the iron is taken from the warrant yards for shipment to consumers. Several thousand tons have been purchased from speculators during the past week. The situation in the South confirms the statements previously made that no large increase in production is probable there. One of the leading companies at Birmingham has been obliged to bank one furnace because it could not get stock, and another is barely able to keep one furnace in operation because of the scarcity of ore and coke. Labor is scarce, for large numbers of negroes have been employed on a railroad contract and have been taken away from the coke ovens and furnace plants. The drought is a serious matter, and is affecting the brown ore miners, who are unable to get sufficient water to wash their ores. It is also having its influence on the coke makers. The largest furnace company in the South has decreased its stock since Oct. 1 at the rate of 1,000 tons per day besides shipping its current output. It is stated that during the past few days the stocks in the warrant yards at Birmingham have fallen off 6,000 tons. We quote for cash, f. o. b. cars Cincinnati: Southern coke, No. 1 foundry, $10; No. 2, $9.75; No. 3, $9.45; gray forge, $9.25; mottled, $9; No. 1 soft, $10; No. 2 soft, $9.75; Belfont coke, No. 1, Lake Superior, $11 to $11.50; Belfont coke, No. 2, Lake Superior, $10.50 to $10.75; Hanging rock charcoal, No. 1, $14.50 to $15.50; Tennessee charcoal, No. 1, $12.50 to $13; Jackson Co. silvery, No. 1, $12.50 to $13; standard Georgia car wheel, $14.25 to $15.

Philadelphia The placing of some ship material is the principal event in sight for the plate mills. Two 5,000-ton steamers for the West India trade are to be built and the material will be let within the week. Plate, sheet and bar mills are well employed on contract work and have orders ahead for some weeks, so that they are not worrying. Consumers are after their material with a persistence that indicates activity in all the ramifications of the trade. Sheet mills are finding it hard to get deliveries promptly and there is a scarcity of prompt sheets. Prices continue as last quoted —refined bar iron and steel bars at 1.15c to 1.20c; tank plates, and angles, 1.20c to 1.25c; beams and channels, 1.25c to 1.40c, according to width. There is a slightly easier market on billets and while $18.50 is generally rated the market, this might be shaded. The pig iron market is relatively quiet. The question of next year's cost still rules the situation, and as long as furnaces are lowering their stocks and are being urged by their customers in the matter of deliveries, they are not making any effort for 1898 business. We quote $12 to $12.50 for No. 1X foundry; $11.25 to $11.50 for No. 2X; $10.50 for No. 2 plain; $10.25 for mill iron and $10.50 to $10.75 for basic pig. There is much confidence in the outlook, and it is believed a large volume of business will come out as soon as the trade has taken its bearings in the new year.

THE National Tube Works Co. last week announced the following changes at McKeesport: Peter Patterson, formerly superintendent, is made consulting engineer; A. M. Saunders succeeding Mr. Patterson and Charles Patterson becoming assistant superintendent. The puddling department of the National Tube Works resumed in full Monday morning and all departments of the company are now in operation employing more men than at any time in the last three years.

THE Carnegie Steel Co., Ltd., secured during the week additional limestone quarries in Mercer County, Pa.

THE Reading Iron Co. has posted notices of a five per cent advance in wages to its 2,800 employes.

THE Reading Iron Co., Reading, Pa., has had plans drawn for two new blast furnaces to be ready for blast by June 1, 1898. To make room for the new plant old stacks will be demolished, together with the stoves heretofore used, and new equipment will be added throughout. Pittsburg and Chicago furnaces are now being inspected by officers of the company and the best features of practice at these plants will be used.

THE Bellaire Steel Works started on double turn last Monday and are now running full except the bar mill. No trouble has occurred thus far between the old and the new employes.

A RECORD for quick work worthy of mention was made last Sunday at the Buhl Steel Works, at Sharon, Pa. A new 20-ton electric traveling crane arrived at the plant, and the first piece was unloaded at 7 A. M. At 3:10 P. M., the crane was in operation and at 4:15 was putting the ingots into the soaking pits. L. G. Buske, representing the Shaw Electric Crane Co., of Muskegon, Mich., engineered the work, and 12 unskilled laborers assisted him. The actual time required to put the crane into operation was seven hours and 40 minutes.

THE IRON TRADE REVIEW

DEVOTED TO IRON AND STEEL MANUFACTURE, FOUNDRY AND MACHINERY TRADES.

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NOVEMBER 4, 1897.

FACTORS IN THE IRON ORE OUTLOOK.

Shipments of Lake Superior ores for 1897 are still under way, and six months remain before the opening of the season of 1898; yet some questions are already being asked as to the prospects of the ore trade for next year. The outlook for prices and production and the possibilities of the continuance of the Bessemer Ore Association, are naturally discussed. The buying of the two big Gogebic properties by the Carnegie interest is also a factor whose bearings are being canvassed; but it is noticeable that this latest departure, though it practically takes the largest ore buyer out of the market, has not caused a tithe of the uneasiness produced at the close of 1896 by the news of the Mountain Iron purchase.

Those who keep closest track of the consumption of Lake Superior ores find in the developments of 1897—though some of these have been little appreciated while the trade has been in the midst of them—compensations for the loss of the ore producers' most important customer. The ore trade has been so in the habit of keeping its eye on shipments and on figures that relate to the producing side of the business that as a rule it has not given the statistics of consumption due importance. Closest students of ore problems in all their bearings, whose acquaintance with the operations of consuming interests has made it possible to gauge closely the use of Lake Superior ores, have made some investigations of late which yield surprising results. The figuring has been based on a very careful analysis of blast furnace operations, taking furnace by furnace of those supplied with Lake Superior ores, and setting down, always on the conservative side, the consumption of Lake Superior ores since May 1, the opening of the season of 1897. Allowance was made for periods of inactivity in individual instances and the consumption of ore was figured at 1.7 ton for each ton of pig iron, taking into account also the probable use of cinder and in some instances of local ores. It appeared from the calculation that if the furnaces now in blast continue active to May 1, 1898, when the new ore season opens—making no estimates for possible additions—the consumption of Lake Superior ores from May to May will reach a total between 13,000,000 and 13,500,000 tons. This is quite beyond anything ever attained in a year. The boom year 1895 was probably three million tons short of it. The situation as it is to-day becomes more impressive when it is stated that the same investigation shows that if the rate at which Lake Superior ores are being consumed to-day is kept up for a year, the total will be 14,700,000 tons.

It would seem that developments whose measure has not been taken until now have been preparing the trade in advance for the removal of a big customer from the market. Similarly the coming in of the Mesabi, which at the first seemed only an unmixed evil, has proved to be only the timely opening of a great storehouse on the verge of a threatened famine.

It might be inferred from the above that events are paving the way for a higher price for ore in 1898. Naturally such a prodigious demand, which means the rapid exhaustion of some of the choicest ore supplies in the world, would suggest that iron mining companies are reaching the point at which they can reasonably expect a better return on their heavy investments. For most of them have seen little profit in 1897—no such profit as is conceded to a business involving so many risks and uncertainties. Another valid argument for a higher price for old-range material lies in the limitations which experience has put upon Mesabi ores as controllers of the market. The Mesabi range this year, hampered as to output by nothing but the unwillingness of furnacemen to use more than so much of it, sends down about 40 per cent of the total from all ranges—possibly a little less.

But there are other considerations that suggest a better price for lake ores next year. Chief of these is that the miners must be paid higher wages. Higher wages were certainly in the programme, as most men in the trade made it up, a year ago, and higher wages would have come but for the set-back given to all calculations by the depressing developments in the ore trade last winter. But when the last of the cheap ore of 1897 has been shipped and the mines start on stocking for 1898, it may be expected that the long delayed and much deserved advance to the miners will come. That advance must be made up to the companies in a higher price for their product. Labor on the lakes is entitled to an advance, and that must be counted on as a factor in freights. Beyond these considerations is the general one that the great iron mining and vessel interests expect to get some share in the prosperity that is coming to the iron industry and that is expected to be more marked in 1898 than in the closing months of 1897.

Account has been taken in most of the discussions concerning next year's ore basis, of the effect of the Carnegie purchase of Gogebic mines on an agreement among old-range producers. This question, we take it, is of minor importance. The policy of the Carnegie Steel Co. has been increasingly away from combinations. In the present case its interest in a high price for old-range Bessemer ores

might be even greater than that of producers themselves. The latter must certainly oppose any advance that gives the Pittsburg interest a pronounced advantage over other steel makers who are the mining companies' best customers. No special advantage could come to other ore producers, moreover, from having the Oliver Mining Co. in the pool unless the latter consented to such a limitation of its output as would make it a buyer, to some extent, of other old-range ores. Yet it would scarcely seem that the Carnegie Steel Co. would go into iron mining with any intention of restricting itself in any particular. Thus it would appear that this question, like the Mesabi question, settles itself, and that any association for next year will be composed of old-range Bessemer mines, outside of the Norrie and the Tilden.

Whatever advance may come in prices, it is certain that the mistake of 1896 will not be repeated. Even if the ore men found themselves able to control the situation we are sure that the disastrous decision of that year would not be made again. Bright as the outlook is for demand; limited as the influence of the Mesabi range is as a bear argument, the great consideration of all is that prices of Lake Superior ores must hereafter be kept on a basis that will permit of the free and regular shipment of American steel products abroad substantially at the prices of the past year. It is evident that the day of any considerable fluctuations in the price of Lake Superior ores has gone by; no doubt the statement can be made broadly of all iron and steel products. The export trade that has been opened up at such cost and by such persistent effort of the steel makers, is at last to reach back to the ore trade and become a controlling influence. There may be some dissent from this view, but we believe the logic of events will force it upon any whose interest would oppose it. There may be owners of mines on Lake Superior who, forced by the peculiar conditions of 1897 to maintain their properties in idleness, are hoping for such a price as will permit them to mine ore for 1898. If 25 cents or 35 cents more on standard Bessemer will enable such mines to cross the line and operate at a profit, they will no doubt be mining their share of the 1898 product. If they must have 50 to 75 cents above the price of to-day, we are convinced that they will not run in the next few years.

It is appreciated more and more among American manufacturers who have accomplished something in winning export trade, that they cannot hold it if for any reason their prices must be advanced materially. The foreign buyer is not used to the American way of alternating feast and famine—of sudden, sharp advances and disastrous reactions. If our manufacturers are learning that the great fluctuations of other years must be avoided at home, if business it to be kept on any healthy basis, and panics and depressions averted, they have far stronger reason for preventing the introduction of this American policy abroad. The foreign buyer will not stand it. It is the very thing he feared when he was led to experiment with American products. Under no circumstances must the realization of his fear be permitted.

The same considerations which apply to ore apply, we take it, to coke, and to labor in all departments of iron and steel manufacture. Lake Superior miners have been making mere existence out of the peculiar dangers and exhausting labor of their calling. They saw in 1895 successive advances to blast furnace and steel works labor, without sharing in them. Some betterment ought to come to the miner now; even with the advance proposed he will still be ill-paid as compared with even the average of labor at furnace and mill.

The point we would emphasize is that throughout the iron and steel trade, beginning at the bottom and working through every line of finished product, any considerable increase over to-day's prices will work injury to the prospect now opening so brightly before the United States. True, other considerations have an influence in determining the ore situation, but they have been more influential in other years than they are to-day. All of them are now dominated by the weighty reasons that look to our destiny as the great supplier of the iron and steel wants of the world.

The figures just available for pig iron production in Great Britain in the first half of 1897 show a total of 4,401,424 tons, or at the rate of 8,802,848 tons for the year. It is noteworthy how close has run the pig iron production of Great Britain and that of the United States in the past 18 months. Our production of pig iron for the first half of this year was 4,403,476 tons or only about 2,000 tons more than that of Great Britain. In 1896 the United States produced 8,623,127 tons and Great Britain 8,659,681 tons, according to the "Mineral Statistics," or 8,563,209 tons, according to the British Iron Trade Association. The boom across the water has brought the British output up to our own; but on the second half of 1897 the two countries part company. The year's output in the United States will be found well in the lead, so rapidly have furnaces been added to the producing list of late.

Personal.

John Needham, a Manchester, Eng., manufacturer, president of John Needham & Sons, of the North Steel & Hardware Co., and of other important industrial companies, is visiting the United States. He has been through Pennsylvania, inspecting the leading steel plants. From Pittsburg he went to the Mahoning Valley, thence to Cleveland, where he is spending this week and will then go on to Chicago. Mr. Needham speaks of the increasing purchases of American products of late, by English manufacturers, and refers to the supplanting of German products by those from this country. He has had occasion to note particularly the increasing trade in American machinery and cycle fittings.

F. H. Reime, of the Davis & Egan Machine Tool Co., Cincinnati, sailed from New York, Oct. 28, for Vienna. He will travel extensively throughout Austria in the interest of his company.

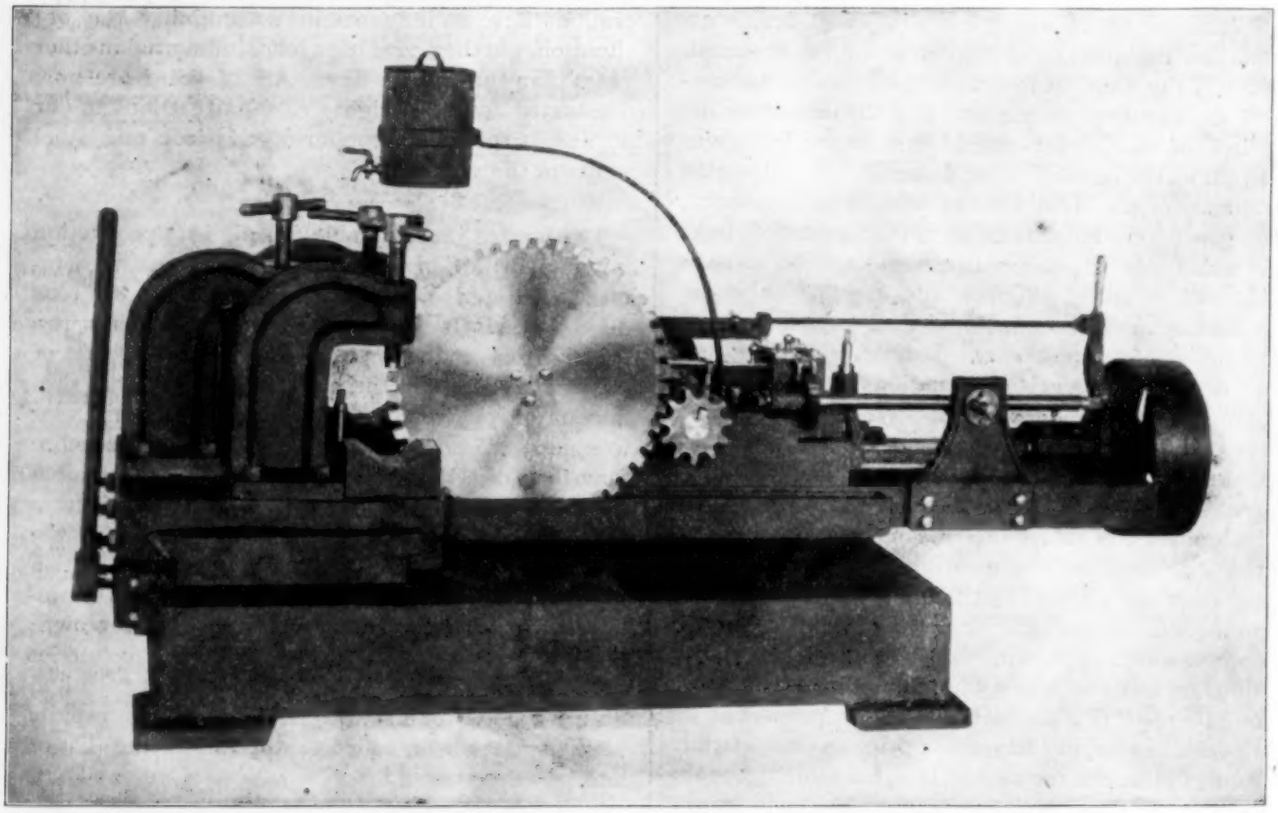
John Ashton, a native of England, one of the foremost founders of the Sharon Iron Co., Sharon, Pa., and the Atlantic Iron Works, died Monday last in Sharon, aged 86 years.

THE South Works of the Illinois Steel Co. made a record last month, by rolling 47,095 tons of rails and billets in 47 turns. This is the best month's work the mill has ever done. The best turn in last month was 2,408 tons of rails and billets, and this, it is thought, is the record of any mill for one turn.

CRANK-SHAFT SAWING MACHINE.

The Q. and C. Co., Chicago, has recently designed a machine for sawing out crank shaft forgings and has demonstrated that the work heretofore accomplished by a planer or slotter can be done in about one-fifth of the time with equal accuracy by this machine. It is equipped with but one saw blade large enough in diameter to make a cut into a crank 10 inches deep; and after one cut has been made the saw is withdrawn from the work, the crank shifted over the required distance for a second cut by means of an adjustable table. The saw blade has also a lateral movement of one and a half inch so as to allow accurate adjustment when setting the work. The mechanism is simple, no gearing being used except the hardened steel worm and a phosphor bronze worm wheel, which are used on the main shaft in connection with a ball thrust bearing for driving the sprocket arbor.

The saw blade is driven by the sprocket which is made of hardened steel and engages the periphery of the saw and is adjustable to the wear of the blade. The saw when cutting is flushed with oil or lubricant by means of an oil pump. There is a variable automatic feed and stop adapted to different sizes and stocks of work. The weight is 6,500 lbs., sufficient to give great rigidity to all the parts.



CRANK-SHAFT SAWING MACHINE.

Pullman Free School of Manual Train ng.

The best form of a monument to the memory of George M. Pullman is provided for by the terms of his will, which was probated in Chicago last week. The 21st clause of the will says: "It is my purpose to found, erect and endow at Pullman, Ill., in my lifetime a free school of manual training for the benefit of the children of persons living or employed at Pullman, and in the accomplishment of that purpose to expend at least $200,000 for lands and buildings and apparatus, and to provide a fund of $1,000,000 for the maintenance, management and endowment of such school." It was unfortunate that death prevented the carrying out of his intentions himself, as it is not likely that anything could have given him more satisfaction than the accomplishment of this purpose. The will further provides, however, that in the event no school is established in Mr. Pullman's lifetime, $1,200,000 is to be used from his estate for the erection and maintenance of the Pullman Free School of Manual Training at Pullman. Norman B. Ream, Robert T. Lincoln, John M. Clark, John S. Runnells, Frank O. Lowden, Charles E. Perkins and John J. Mitchell are to act as the first board of directors of the school. These men are fully competent to carry out the wishes of Mr. Pullman in the establishment of the school, and it would be difficult to select persons better qualified to take its management.

The endowment is sufficiently liberal to make the school one of the foremost of its kind in this country, and to compare favorably with the best industrial schools of Europe. There is no doubt that this country needs above all things schools of this kind, and while there are several now in operation, two of them, the Lewis Institute and the Armour Institute, in Chicago, many more can be started before our needs in this direction are satisfied. A graduate of a manual training school is able to take a much higher position in an engineering trade than is a boy who has only served an apprenticeship in actual shop work, as, in addition to the practical operations mastered, he obtains an acquaintance with a wide field of technical literature and an impulse to continue research on approved lines, in his active life.

Another Bessemer Mill Record Broken.

At the Ohio Steel Co.'s plant, at Youngstown, O., on Friday night, Oct. 29, all the records at this mill were broken—and some of them have been large—by an output of 382 ingots in 12 hours. There were stops of 48 minutes due to breakdowns, indicating that with all things favorable, even better could have been done. The tonnage is not stated, but at two and a half tons to the ingot, the output for the 12 hours would amount to 955 tons.

THE Wellston Furnace, at Jackson, O., has advanced wages 10 per cent. The Star Furnace, of Jackson, also a producer of high-silicon iron, has just gone into blast.

THE Meehan Boiler & Construction Co., Lowellville, O., has recently finished a Kennedy hot blast stove, 18x80 ft., for the Andrews Bros. Co., Youngstown, O.

THE Johnson Co., with Nov. 1, put the men in the Bessemer department at its Lorain plant on a tonnage basis instead of on day wages. The change means 15 per cent advance.

CONDENSED FROM THE TECHNICAL PRESS.

Double Hardening of Steel.—*Dingler's Polytechnisches Journal*, of Sept. 10, reviews a peculiar process of hardning steel which is in vogue in France, and goes under the name of double hardening. The characteristic feature of this process is the reheating of a hardened steel to a temperature somewhat lower than used first, and then agian quenching it. The usual method of procedure in tempering tools is to allow the second heating to proceed only up to the points indicated by the well known color ranges of the film of oxide, corresponding to the tewper desired for the tool. M. Godeaux has published a report on the subject of double tempering, as discovered by Walrand and Cottin in Creusot. The influence of the double hardening on the mechanical properties of steel were first noticed in the peculiar appearance of the fracture of a double hardened leaf of spring steel. Repeated trails to produce the same characteristic in the fracture of other steels brought out the remarkable range of changes in their properties due to double hardening them. The hardness, elasticity, and tensile strength, could be greatly increased, while the brittleness under shock could be diminished. The process is of special value for axles, connecting rods, piston rods, etc. While a soft steel is considerably improved by this treatment, the best results are obtained with steels of medium hardness. This steel however, being somewhat expensive, its use is best restricted to parts of machinery which are subject to wear, such as guides, piston rods, and mine car wheels. A steel with about .40 carbon is the best. As a result of the double hardening process, a certain change takes place, consequently it is best to treat the pieces while in the roubgh state and finished up afterwards. For large work it is advisable to build special heating furnaces. At Indret, pieces 20 feet in length are treated. The heat must be uniform, and the first hardening is accomplished with a bright red heat (au rouge jaune), the second with a darkened heat (au rouge sombre). The harder the steel, the lower the temperature to be employed, and it is best in guaging the heat by the eye to do so in the darkness. Water at 140 degrees F. is the best quenching material, all the usual precautions known to tool makers being taken. It is furthermore well to leave the work for some time to avoid the formation of cracks. A number of tests are given to show the remarkable increase in the ultimate strength and elastic limit, but also the corresponding decrease in the elongation. The effect on the bending quality of the steels, so far as their resistance to shocks is concerned, is said to be a great improvement, and the wearing quality of a number of double hardened machine parts are cited. The tendency of all these tests however, seems to point to an increased resistance to a change of form under shock rather than the resistance to actual rupture in service, for Le Chatelier has noted that the resistance to hammer blows is somewhat lessened by this double hardening. M.

The Development of the Swedish Iron Industry.—[*Stahl und Eisen*, Sept. 1.]—Axel Wahlberg read a paper on this subject before the International Society for Testing Materials of Construction. In it he traces the origin of the iron industry in Sweden to the "Iron Age," 500 years B. C. Wrought iron was produced directly from bog ores in conical shaft furnaces fired with wood and blown by hand power. The lumps of iron thus obtained were called "Osmund," and went by that name the world over. Pig iron was produced in the middle of the 15th century. In former times phosphorus played a very small part, as it was not reduced out of the ores; with the advent of pig iron, however the conditions were changed, and the value of the beds of pure iron ore came to be fully appreciated. Immense forests and abundant water power were advantages which no other nation possessed in equal measure, and as a consequence the middle of the 18th century found countless small iron works scattered throughout Sweden, and at that time the industry was at its zenith of expansion. With the advent of the puddling process in 1788, which was brought out by Cort in England, things began to go down hill. The further improvement in the puddling process made by Rogers in 1824, which allowed these of pig with higher phosphorus was a serious blow to Sweden, and cut down its output to such an extent that Swedish iron was thereafter used only for work of the highest class. In spite of these adverse conditions, improvements kept apace with the times, and in changing from the old German hearth methods of refining to the Lancashire method, a new impetus was given to Sweden's iron industry. This change came about in 1830 to 1840, and so thoroughly was the system adopted that the later open-hearth methods of producing ingot steel only surpasses the production of Swedes iron in output in 1895. The introduction of better roasting methods for ores dates from the middle of this century, Westman's ovens for this purpose being fired with the waste furnace gases. Warm blast came in about this time also. A very interesting portion of the paper is the mention made of Sweden's share of the success of the Bessemer process. Next came the Siemens-Martin process, or as it is called on the continent—the Martin process. The Thomas Gilchrist, or basic Bessemer process, came over from England in 1879, and taking care of ores high in phosphorus, naturally was a blow to high prices obtained for the purer ores. While the iron industry of Sweden is retrogradin r, so far as its relative position in the world's production is concerned, yet there is a healthy yearly increase which enables that country to look into the future with full confidence in its resources. A statistical review of the number of blast furnaces, puddling ovens, open-hearth and other furnaces, converters, etc., running in 1895 concludes the paper. M.

THE TIN PLATE MARKET.

The dull market noted last week has continued, and comparatively little interest has been manifested in tin plates either east or west. The canning trade has consumed fewer cans this year than was expected. A large number of empty cans will be carried over into next year by the packers, as well as by the can makers. This fact alone has caused many of the larger can makers to withhold their orders of tin plates, which are usually placed at about this time, and their uncertainty in regard to the consumption of tin plates next year for this particular branch will probably deter them placing contracts until late in the spring.

The tin plate mills are still suffering from scarcity of tin plate bars and a number have been obliged to close down entirely during the past month. The resulting curtailment of output however, has had comparatively little effect upon the market, and buyers for nearby deliveries seem well supplied.

The terne plate business, which a month ago was quite brisk, has fallen off materially and jobbers report that only small orders are being received and the trade in that particular article is very unsatisfactory.

The mills are still well filled with orders and during the past week a number of large orders have been declined by makers even for delivery before March 1. It is understood that these orders were not for actual consumption, but in a way speculative. The makers all seem confident that a much stronger market will follow the first of the year and that any unfilled capacity will be sold without difficulty at prices better than those now obtainable. Quotations remain practically unchanged, as follows, f. o. b. maker's mill, Indiana or Pittsburg district:

CHARCOAL TINS.

	IC	IX
Lisvane Grade,	$3.45	$4.20
Calland Grade,	3.65	4.35

COKE TINS.

IC, 108 lb. Basis weight,	$3.00
100 lb. " "	2.90
95 lb. " "	2.85
90 lb. " "	2.80
85 lb. " "	2.75
80 lb. " "	2.70

TERNE PLATES.

IC, 216 lb., 20 x 28	$5.95
200 lb. "	5.65

Our excellent and successful contemporary the *Colliery Engineer and Metal Miner*, published at Scranton, Pa., which covers so well all that pertains to mining, changes its name with the November issue to *Mines and Minerals*. The name is more descriptive of the wide field covered by the paper, which has the largest circulation of any mining publication in the country.

LAKE SUPERIOR IRON MINES.

The iron ore miners at Ishpeming and Negaunee, Mich., through the officers of their local unions have sent letters to the mining companies asking a 15 per cent increase in wages. They ask that it go into effect before winter sets in. No strike is proposed, but the communication says the request is made in view of the return of prosperity, the condition of the iron market, the promises of a year ago and the inadequate wages now being paid. No formal answer is expected, but the leaders professed to have some assurance that an increase is being seriously considered.

Important improvements are in progress at the Salisbury mine of the Cleveland-Cliffs Iron Co., at Ishpeming, Mich. The shaft house, said to be the largest on the Marquette range, is nearly completed. It is 80 feet high and 35x35. It is placed close to the old open pit, and an opening has been made from the bottom of the open pit to the underground workings of the mine. Work on the new engine house is going on. It is so placed that the sinking of the ground which has heretofore threatened the power plants at this mine, will not affect it.

Boilers are being taken from the Platt mine on the Cascade range for shipment to the Hibbing, Minn., property which Eddy Bros. are developing.

There is no activity in Lake Superior iron mining stocks, but asking prices are reported a trifle higher. Holders of Republic ask $12, though the stock is quoted at $11 —par value $25. Lake Superior, par value, $25, is held at $28; Chandler, par value, $25, at $38 and $39; Minnesota Iron Co., par value, $100, at $60, and Cleveland-Cliffs Iron Co., par $100, at $36.

The Biwabik mine on the Mesabi range, has made an output of 425,000 tons this season and has closed down. The Mountain Iron has made shipments of 765,000 tons this year. After nearly shutting down the mine has resumed operations and will ship about 25,000 tons more. The Mountain Iron and Oliver properties together will send out about 1,400,000 tons for the season. At the Mahoning mine at Hibbing, shipments have ceased, with the total something under 525,000 tons. It is expected that this will be considerably increased next year.

The annual meeting of the Metropolitan Iron & Land Co., which owns the Norrie group of mines, was held at the offices of the company in Milwaukee, Saturday, Oct. 30. The Oliver Mining Co. interest was represented and its acquisition of the control of the company was made formally effective in the election of directors, the following being chosen: H. W. Oliver, H. M. Curry, D. H. Clemson, and James Gayley, Pittsburg, and Capt. S. S. Curry, Ironwood, Mich. The directors elected the following officers: President, H. W. Oliver; treasurer, H. M. Curry; secretary, C. D. Frazer, all of Pittsburg. General Manager N. P. Hulst, of the company, will locate his office in Milwaukee. The offices of the company will be removed to Pittsburg.

The Pewabic Co. will begin at once the erection of a concentrating plant at Iron Mountain and has contracted for crushers, rollers and jiggers and engine and boiler house. The ore to be concentrated is next to the Pewabic mine and is held in sandstone. It will be won by means of drifts into the side hill, with underground workings. After being crushed to one and a half inch pieces, the ore will be sorted and in this process about 40 per cent of it can be secured. The balance will be concentrated by jigging and washing. The concentrates run as high as 66 per cent in iron and very low in phosphorus. Three tons of material are handled for every ton of concentrates. A daily output of 300 tons is counted on and 50 men will be employed.

It is reported that the fee-owners of the Zenith mine on the Vermilion range have agreed to forego royalties for 18 months, while the lessees put the property in shape for a considerable output. New hoisting machinery will be put in after the shaft has been sunk 75 feet deeper.

After shipping 37,500 tons from its stockpiles the Florence mine has 90,000 tons of ore on hand.

The option of the Carnegie-Oliver interest on the Pioneer mine ran out with Nov. 1. It is still possible that the mine will be acquired, but negotiations will have to be taken up on a new line. There is a three-cornered complication that may prevent any agreement. The present lease, it is stated, has nine years to run. That is not long enough to warrant the Pittsburg interest in simply buying out the lessees. And the fee-owners are not in position to negotiate directly with the would-be purchasers because of the lease. The Oliver Mining Co. has sought a 20-year lease. The present lessees would like an extension of their lease to 20 years at a low royalty so that they can lease again and make a profit. It is the desire of fee-owners and lessees to reap the profit to be had from the transfer of the property to the Carnegie-Oliver combination that causes the hitch. A 35-cent royalty, 500,000 ton minimum, for 20 years and a bonus of $1,250,000 constitute the basis of the last proposition discussed between the Pittsburg interest and the lessees.

The big pump in No. 2 shaft at the Chapin mine will be replaced by a new Riedler water-end, compound pumping engine. It will be similar to the Riedler pump purchased for the same property early this year.

INDUSTRIAL BRIEFS.

The Reeves Iron Co., Canal Dover, O., has resumed in several departments that have long been idle.

Contracts for two new pumping engines were let by the City of Chicago, Oct. 26. One is to be placed at the 14th st. station, and have a capacity of 30,000,000 gallons daily. The contract for this was secured by the Lake Erie Engineering Works, at $83,875. The other pump is to go in the 68th st. station, and to have a capacity of 1,400,000 gallons daily. The Holly Pump Co., secured this contract at $45,075.

The Totten & Hogg Iron & Steel Foundry Co., manufacturer of rolling mill engines, rolling mills and tin mills, has received an order from the Laughlin Nail Co., of Wheeling, for the latter's new tin plate mill. The Totten & Hogg Co.'s order includes buildings, covering an area of 65,500 sq. ft. of ground; a 1,500 h. p. Aetna rolling mill engine; three smaller engines, boilers of sufficient capacity for the engines, 16 mills, three electric traveling cranes, shafting, pulleys, etc., for driving shears and tin house, roll lathes, 17 pair of shears, pickling, tinning, branning and dusting machines—in short the plant complete.

At Allentown, Pa., the water board has awarded the contract to furnish 924 feet of pipe to the Warren Foundry & Machine Co., at $17.70 a gross ton. R. D. Wood & Co., Philadelphia, bid $18.27 a gross ton.

The following bids have been received by the Navy Department: For furnishing 30 sets of gun forgings for auxiliary cruisers; the Benjamin Atha & Illingworth Co., Newark, N. J., 24 cts. a lb.; the Midvale Steel Co., Midvale, Pa., 25½ cts. a lb.; the Bethlehem Steel Co., Bethlehem, Pa., 25¼ cts. a lb.

A train of 55 wooden cars of the old style, containing 1,670 tons of iron ore, ran from Conneaut, O., over the Pittsburg, Bessemer & Lake Erie Railroad, Oct. 29. The entire line is in good shape.

At Philadelphia, Oct. 29, Judge Butler in United States Court of Appeals, sustained the verdict for $15, 967.50 rendered before Judge Acheson, in Pittsburg, against Corrigan, McKinney & Co., of Cleveland, for violation of their agreement to return in good repair the blast furnace leased by them from the Sharpsville Furnace Co., of Sharpsville, Pa.

The Leechburg Foundry & Machine Co., of Pittsburg, has been awarded a contract by the Neshannock Sheet & Tin Plate Co., of New Castle, Pa., for converting four sheet mills into tin mills, furnishing the necessary rolls, providing one Mesta patent pickler, and putting in a practically new six-mill tandem cold rolling train.

The bid of the River Machine & Boiler Co., Cleveland, $13,316, for riveted steel pipe for Superior street tunnel was accepted by the Cleveland city council. The other bids ranged from $13,447 to $18,390.

The city council of Cleveland decided to accept the bid of the Ohio Heating & Mfg. Co. to supply six Geary water-tube boilers for the Division st. pumping station at $22,760. Later the Aultman & Taylor Machinery Co., of Mansfield, O., manufacturers of the Cahall boiler, called attention to informalities in the bid of the Ohio Heating & Mfg. Co., and of two other concerns and claimed the contract. The matter is still under discussion. The Ohio Heating & Mfg. Co. gave no address.

VIEWS ON MOLDING SAND.

Interesting Discussion by Western Foundrymen

A profitable feature of the fall meeting of the recent Western Foundrymen's Association's fall meeting at Cincinnati, was the discussion on the paper of D. H. Truesdale, of Cribben, Sexton & Co., Chicago. Mr. Truesdale's paper was printed in our last issue. The discussion upon it follows:

Charles A. Bauer: In our practice no facing is used. Our castings are about of medium weight, and we get a very fair surface without facings. The sand that we use is known as Sandusky sand. We use for our cores almost exclusively silica sand, with very good results.

C. F. McGilvery: Some years ago we used some silica sand. I think it is called Dresden sand. I ordered a car of the sand and thought we would do without facings, but had trouble with the molders to get them to use it. They were not careful enough. Since that time we have had to use facings. There is no doubt that if you use sand with fine silica you can do without facings and I think make better and sharper castings, but that sand has not got the bond that the ordinary molding sand has. It requires harder ramming and a little more work, and the men object to that. Still I think it makes a better surface on the castings and makes them sharper, possibly because you have to give them a harder ramming. As a rule too much fine sand is used, and too little elbow grease. I think there is one of our mistakes in rough castings. You take fine sand and ram it hard and of course it will stand. To make the surface the same on molds it is necessary to ram coarser sand a little harder. That requires more labor, and that means more money.

John D. Sadler: I have had some little experience with facings and sands of different character, with a larger and heavier grade of castings in loam work, dry sand and green sand, and also for steel. I believe that I was one of the first users of silica sand as a facing for molding in the country. That was brought about some years ago when steel was introduced to this country as Bessemer steel. I was employed by the Cambria Iron Co., at Johnstown, for about three years, from 1871 to 1874, in experimenting to get a facing that would stand the steel. We found after a long experiment that silica sand was about the only sand that would give satisfaction. It required a very fine grade of sand, as in the steel the crystals are very fine. In order to prevent the steel from entering into the pores of the sand, you have to have it finer than the crystals of the steel. It requires a sand without a great expansion so that it would stand up against the intense heat at which steel castings are poured. So we found that silica was the best sand to stand that. I found afterwards that the use of silica sand in loam work was a great advantage; taking burned sand-burned silica, burned core sand—and using a quantity of it in the loam you got a mixture from which you could get a wonderful result. I have a simple method for testing sand where you don't have a chance to make chemical analyses, which anyone can use; make up a ball of sand and subject it to a severe fire similar to what you get when the iron is poured against it; and if the sand browns nicely instead of crumbling away, you can almost be sure that it will stand the iron. We had an instance of that some years ago in making some very large gears. We had trouble getting the teeth. The scales would fall off the mold and you could just brush the teeth right off. I was called to see if I could find out where was the trouble. They had a mold made with the teeth all around under the gear. I took a quantity of waste saturated it with oil and ran a ring around near the teeth. There were no arms to interfere, and there was a good chance to put a ring in front of the teeth. Then I applied a lighted match to it and you would see the teeth slide right off. There was some kind of soft quick-sand of a clayish nature, and the moment the heat got against it, it didn't seem to dry in the bond; it seemed to slide away. If you take a ball of sand and subject it to the fire, and it stands up against a quick fire you may be sure it will stand the iron, if it is open enough so it will allow a vent to escape. It is a simple, easy test. In lighter or finer castings you have to be governed by the fineness of the sand to have a surface on the casting.

Mr. Moore: Your experience has been in the nature of bringing up sand which contained a larger amount of bond and a small amount of silica.

Mr. Sadler: I find that is more trouble than anything else. Sand certainly requires a certain amount of bond. As much water should be used as possible. Some make a mistake in having sand that is really too close, too strong, too much clay. You must use water enough and ram it hard enough. Those things are usually more the cause of losing castings than anything else I know of.

H. F. Frohman: Facings are any material which is refractory; that is, which will stand any amount of heat, greater than melted iron. The generally acceped idea is that anything black is a facing. That is a mistake. During the last few years we have been intruodcing a silica also used for facing, which stands a greater amount of heat than some of the other black facings, especially on such work as steel, where the metal is poured with a greater amount of heat. Regarding silica, if you grind it fine enough it will make a good facing. Silica sand itself will make a good facing if fine enough; but my own idea of a facing is that it should overcome the difficulty to which Mr. Truesdale refers: "No more alumina or clay should be present than is necessary, as any increase over the proper percentage makes bad, rough work, by its melting adhering to the casting, causing extra expense in cleaning." As you know, in some parts of the country they have not got the best sand, and it costs too much to bring the best sand to those points where they might otherwise be used to advantage. Many have not the facilities, nor do they care to invest in sands most suitable to their class of work. We recommend and it is absolutely necessary in such cases to have facings to cover up and protect that part of the sand from melting and adhering to the casting. In regard to the non-use of blackings and facings on certain kinds of work, we have seen—this is not my experience only, but it is a fact,—that it can be done, although looking at it in a business point of view, it might not be the thing for me to say that castings can be produced in that way. But we always claim there is extra expense in so doing—that is, probably more so than with the use of blackings and facings.

A. Bell: I suppose most of you are familair with the sand from Sandusky. We have found the sand which is recommended as suitable to make castings without facings too expensive, and in some instances as much as $4 a ton, when on the other hand, we could buy sand which was satisfactory to us at from $1 to $1.25. This sand we could not find any fault with, consequently we have abandoned the higher priced sand, some of which has a national reputation, and are using a sand which we can get for about five cents per barrel, which we consider a very good sand for our purposes.

Clinton Truesdale: In bringing forth my little explanation of castings this morning [referring to castings on exhibition, including bust of ex-President Harrison] I did it for the purposes of carrying out the desires and wishes of my uncle, D. H. Truesdale. I wish to say that I have been associated with him and got my training strictly under his observation for the last 20 years; and I say without any fear, and I know some of the gentlemen will bear me out, that I consider him one of the brightest men in modern foundry practice. These castings which I have been showing you are strictly in the line of stove-plate—light castings, and Mr. Truesdale's experience and mine also is confined exclusively to stove shops. In fact, I have no knowledge very far reaching in respect to heavy machinery, or any thin of that kind; but we have been giving the subject of silica considerable study for some time, and how well we have succeeded I leave to the gentlemen here, and after they have examined the display I think they will bear me out that we have got along very well. In regard to the facing question, I have succeeeded in the past two years, after experimenting in grinding silica sand in ball mills, with the use of iron dogs, which I used exclusively in our machine shop—William Resor & Co., Cincinnati,—in using it for facings, thereby dispensing with the use of facings. I have used a proportion of three fourths silica sand and one-fourth Newport sand—found over in Kentucky, our neighboring state. I also found it gave good results by adding to it fire clay, to be made into cores. I have succeeded in introducing silica sand, a very fine grade, found 60 miles south of Louisville, in the foundries here in the city, where they have never had opportunities to make large cores,

among them Erhart & Co. They tell me they have had great results where heretofore they have lost three or four out of five pieces of castings caused by a bad core, which difficulty they have now overcome. They have dispensed in a great measure with their blacking. Cores made of silica sand will run out, as D. H. Truesdale says, at the mere tap of a hammer. Castings made with silica sand will not scale as readily as those made with facings, and have a very fine smooth surface. I have on exhibition this morning, some castings showing gates directly on the face, very fine lines; also some gated on a smooth surface. You will see at a glance how it scales and cleans. It is not vitrified or burned off. In fact, in my judgment, there is no end to the use of silica in modern foundry practice.

H. S. Vrooman: All sand contains more or less silica. I can't see wherein silica introduced into sand could make it peel from the casting any more freely. There is only one point—it makes it more porous. If you take the iron, for example, that contains all the carbon up to a point of saturation, you could introduce no more carbon into it. If you have a sand that contains a sufficient quantity of silica, the introduction of any more will not do any good. As far as making it more refractory, I can't see how it will do that either; because the alumina in itself is non-fusible—the silica is non-fusible. I can see, as this gentleman says, a test in trying sand to see whether it will hold up under sudden heat. There is only one thing which that shows, that the sand which comes down very quickly under sudden heat contains a large amount of vegetable matter. The introduction of silica sand will possibly make that percentage of vegetable matter so much smaller in proportion to the amount of sand that it will not show, and, therefore, not come down. And if the sand contains a sufficient amount of silica in the beginning, I don't see wherein this introduction of silica will do any good. If we have to hunt around to find sand that has 60 to 75 per cent of alumina, in order to carry the silica, you could just as well look around for a sand that has a sufficient amount of silica in the beginning without adding it. Now, silica is in two forms, combined and free, in sand. All the sands we have contain a certain per cent of silica. The variation in the percentage may affect its porosity or refractoriness. The question as to how long sand will wear or stand heat does not depend, in my opinion, upon the amount of silica it contains, nor on the amount of alumina it contains, but upon its crystal formation. Some sands, or crystals, are conductors of heat; others are not. Chemistry tells us that alumina when subjected to red heat, loses its adhesive qualities. So if the sand has been subjected to a red heat, it will no longer contain the water. You may take a fire clay supposed to be as refractory as any, make brick of it and put it in the oven and subject it to a red heat; then take it out and regrind it, and it will never combine with water again; the adhesive quality is gone, because it has been subjected to a red heat. In the sand it is the same, because wherever the face of the mold comes in contact with the molten iron, the face of that mold must become heated to a red heat; and owing to the structure of the crystals, whether it is a conductor or a non-conductor of heat, that red heat penetrates further into your mold. The lines are well defined. If you shake out the mold and take the casting out, you will find a dark colored line. Seems as though the sand has dried out. In some instances it follows deeper into the mold than in others. If you get a sand crystal formation that is a non-conductor of heat, that red heat penetrates further into the mold owing to its crystalline construction. As to the amount of alumina or the amount of silica which a sand contains, I would advise all to use as open sand as it is possible for them to get, for three reasons: First, that you work it better; second, you can ram it harder; and, third, it will vent easier. There is no question that a sand suitable for any class of work can be found in nature, if the consumer wants to pay for it; and a sand that is strong of clay does not make a long-lived sand. Mr. Sadler can make a sand very high in clay or alumina and test it with his sudden heat and it will stand; and at the same time it will not make a good sand for the work.

Mr. Sadler: In reply to the last remark, I would say, that I grant that clay can be subjected to severe heat and still stand it well; but I would suggest that at the same time the sand would have to be judged as to whether it was open and porous enough, in order to allow the vent to escape; and if it did it would stand up to the work and the iron. If it stood the test of a severe fire and the test was similar to the iron running into a mold, something of that same character that iron going in there heats up the surface of the mold very rapidly. If it doesn't stand a severe fire similar to that, it will not stand there. I suggested a simple test. I have found some sands won't do in the molds; they will crumble away. With reference to the use of Sandusky sand, nearly all Sandusky sand has a greater percentage of lime. Some of the sands we use from Sandusky have more limestone, than finer sand, which burns out and forms a quick lime by the heat coming into contact with the limestone in the sand. This will mix in with the iron of the casting and sometimes produce holes in the casting, especially if the sand is worked just a little dry. Right in front of the gate by the heavy body of metal running against it, it will burn, the same as limestone will burn in the kiln. It will burn back for some little distance and give some trouble.

Mr. Moore: Mr. Sadler, your use of silica has been in bringing up the silica in sands which were deficient. It would be interesting, I think, to those present to know the percentage which you found necessary.

Mr. Sadler: Well, that I would be unable to give, because I have never had an analysis made of any of the sand we use; but that can be very readily determined as to what point you desire to bring it up by actual experience in the shop. You can see just what amount would produce the best results in any one particular case. In one instance a firm in Chicago was having a great deal of trouble with their loam castings; they would be covered with small light scabs, literally covering the whole surface of the casting. They asked me to look at the work. It was an awful job; those light scabs would not be more than one-tenth to one-eighth of an inch in thickness. I took some of the burnt sand which had a good deal of silica in it, and added that to the loam to open it up, and that ended the trouble there. A great many foundrymen throw out just what they want when they throw out sand that has once been used under the impression that that sand is burned—in the way of cores, etc., as waste; but a great deal of it is the best thing that foundrymen can have by careful, judicious use of it. Too much of it is not good; but a certain proportion or quantity of it, and in regard to the proportion, you must be governed entirely by the sand which you have. In a new sand you will have to be guided by results from actual experiment in practice.

Mr. Bauer: I wish to state that we take from 8,000 to 10,000 tons per year of the Sandusky sand, and of all the sands we have yet used have not found any sand, without any exception, that was as free from lime as the Sandusky sand; and I would say that there is only one sand that I have ever known which contains less lime than the Sandusky sand. I want further to say that anyone who has ever analyzed any of the Sandusky sand will find that lime is an awful scarce quantity in it.

H. S. Vrooman: I think iron is always to be found in sand that is red in color. It seems to me as though this iron disintegrates in some manner. When such sand lies out in the open air there is a kind of oxidation takes place in that sand and it becomes soft and free, whereas, sand which does not contian considerable iron under the same circumstances, becomes hard and lumpy, and you have got to crack it with a hammer. In regard to fine sand, I think they carry it to an extreme, try to make too large work with fine sand. Take a sand that is too fine, when you take your pattern from your mold and let it dry, you will find on the surface a very fine quality of sand that adheres to it. If the sand is coarser that will not occur. The sand is too fine in my opinion.

Mr. Moore: I visited a little foundry down in Birmingham, Ala., where they were making grate bars, manufacturing castings which were good enough, but very rough. I was very much surprised, from the character of the foundry and the help employed and their lack of ordinary appliances, to note the excellence of their castings; the sand which they used there is of a reddish nature, and presumably because there is a great abundance of iron ore in the country, contains considerable iron. The value of iron in a sand mixture occurred to me then; and I hope that some one is able to cast further light upon the question which Mr. Vrooman has raised.

S. S. Knight: I suppose in the last year we have some 200 or 300 analyses of various molding sands throughout the country from Albany molding sand to as far west as Denver, Colorado; and in the whole catalogue we have scarcely found enough lime in any one molding sand to amount to anything at all, that is, in the sand itself. It is very hard to find lime in sand, and when it is there, if the sand has ever been fused it is in the form of calcium silicate because calcium being a very active agent, it will naturally combine with silica dioxide, or with alumina, which is nothing but clay. There is one thing in which all foundrymen are interested, and that is, some standard grading of sand. It is now purely a relative matter nothing absolute about it. If the standard is to be based upon analysis, the ordinary silica we hold should run at least seven per cent; the iron oxide should not be below six per cent and the alumina, should be at least four or five per cent in addition to what would naturally be confined to the silica. However, the best test which I know for the fineness of sand is simply weighing a certain quantity of your sand, drying it first in the oven at a temperature above the boiling point of water, 212 degrees to 220 degrees F., and putting it through a standard mesh sieve, 30 meshes to the inch. Of course if you want 40 meshes to the inch, it can be used. The test is purely relative; but whatever sand you are using you will have to state that mesh you are using to afford any idea to anybody as to how much of it you can force through the sieve by shaking. In regard to iron in a sand, a molding sand that would come to us without at least five per cent of iron oxide in it, would be rejected. We would not think of taking it. It would not answer our purposes at all. The iron oxide in a sand gives it a red color, of course, but it also gives it a certain strength and tenacity which nothing else does. If you are using facing on your molds, the one thing to be watched, as far as we know at present, is clay, because clay is nothing but decomposed feldspar. The moment you put a great deal of clay in your molding sand, which is largely silicon dioxide, it will fuse up against it and with the facing form an ash; and you are going to have a scale on the casting, sure.

Mr. Moore: You state, if I understand you, that you don't consider a sand which contains less than six or seven per cent of iron oxide as proper, at least for your purposes. Do I so understand you?

Mr. Knight: I made that statement. However, we have a great deal of sand that runs nearer five per cent, but nothing below five per cent will be accepted. Of course, you understand our work is not ordinary work. Possibly you could go as low as three per cent for ordinary work; but I can't see how any sand with less than three per cent would be accepted.

Mr. Moore: If there were 10 or 15 per cent of iron oxide in the sand, what would be the result?

Mr. Knight: I can scarcely see how you could have 15 per cent in your sand, unless you are reducing iron ore for the purpose of putting it in the sand. In that case it would be possible, if you ground up your ore and put it in the sand. However, your sand would not be increased in strength, because you are simply getting a physical mixture. You are not doing any mechanically combined iron in your sand. In molding sand you have iron disseminated through the entire mass in a way you could not possibly do physically, if you were to put it in a disintegrater.

Mr. Moore: The iron which you find in sand is in what form?

Mr. Knight: In the form of an oxide.

Mr. Moore: And as associated with the alumina, or with the sharp sand, silica?

Mr. Knight: I suppose you mean whether it is a chemical combination or not, with the alumina or silica? I have never made any analyses in regard to that point; I hardly see how it would be possible for it to be associated with alumina or silica either. It would be in the form of iron oxide. It might be possible to have some such combination as alumina ferride.

Mr. Vrooman: I agree with Mr. Knight in what he says as to the necessity for a better grading of sand. At present nobody grades sand alike. A man strikes sand on his farm, possibly in two veins, and he brings it in and says one is No. 1 and the other No. 2. He doesn't know why, nor anybody else; and he sells it to us. Another man comes along, and he says, "I see you are using No. 2 sand." He has struck something that he calls No. 2. It may be finer or coarser than the other man's sand of the same number. The way to grade sand is to put it through meshes. I would say with sand of which 90 per cent goes through, I would call it by the number of the mesh that you had forced it through after being dried. Then if you bought sand from anybody and found it to be too coarse or too fine by that standard, you could so designate it; you could tell the man that it was too coarse or too fine, and he would know how to furnish it to you.

Mr. Sadler: There is an appearance, an indication right along where there is a gate—where the metal strikes the mold, a white substance appears and afterwards you can break it and find small portions of a white powder that resembles lime, that is back in the sand. I ask, if I am wrong, what is it? I haven't any knowledge it was lime, but our sand came from a locality where there are great quantities of limestone and I reasoned that the limestone, a portion of it, became small, so that it was taken up with the sand. Thinking that that was the case was where I was led astray according to the chemical analysis that has been made by others here and their statements.

H. S. Vrooman: I think that is lime, showing the depth to which the red heat has penetrated the sand, and possibly there may be some vegetable matter in it.

Mr. Sorge: Mr. Knight said he never in any case found a sufficient amount of lime in any sand to do it any harm. Will he let me know what percentage he did find in it, and whether he did not occasionally find carbonate as well as sulphate?

Mr. Knight: Any carbonate in molding sand would be in such slight quantity it would not have a tendency to fuse the sand. I couldn't say as to the percentage. I would have to look back over our books. I am sure it was below one per cent.

Mr. Sorge: I know there is a sand in our direction which contains between four per cent and five per cent of carbonate. In the locality of Joliet, I know the effect of the lime is every distinct and disastrous.

Mr. Knight: If lime comes up to five per cent, it would be disastrous in coming in contact with hot iron. It is beyond our experience to find any sand of that character.

Mr. Bauer: I should think if any molding sand contained five per cent carbonate it ought to be ruled out and called by some other name. It has been baptized improperly.

Mr. Sorge: It was ruled out. It was called molding sand for a great many years.

Mr. Vrooman: When I was working at the trade, it was very often the custom—and I guess it is to-day—where we had a flat coat on the surface to shake some lime on the face of the mold, which seemed to keep the sand from cutting, and also hold the facing better.

Mr. Sadler: In relation to putting lime on a mold. The trouble comes in at the point at which, being subjected to heat, the change is going on from stone to lime. I have used lime and lots of it in connection with the reduction of metals. Perhaps on the mold it is all right, creating a moisture and holding the sand together, also saving, ofttimes, a washing. I don't know of anything really much better than a little lime dust used the same as it would be in facing.

The Pittsburg Valve & Machine Co., Ltd., was recently organized in Pittsburg and the property at River avenue and Balkam street, Allegheny, occupied in turn by the Duff's Patents Co., Supply Mfg. Co., and Hartley-Rose Belting Co., has been fitted up for the use of the new company. Three of the officers of the company, George E. Klingelhofer, chairman, Robt. C. Bromley, mechanical engineer, and Geo. H. Kanne, superintendent, were for a number of years connected with Atwood & McCaffrey, of Pittsburg. The company is already busy on pipe work in connection with boilers, engines, pumps and condensers for steel works, rolling mills and blast furnaces.

The Detroit Graphite Mfg. Co., manufacturers of the Superior graphite paint has opened a branch office in the Tradesmen's Bldg., Pittsburg, in charge of Geo. H. Richardson. The Superior graphite paint is used largely in the Pittsburg district on structural steel, tanks, boilers or metal work exposed to heat, cold or acids.

COMPARATIVE FUSIBILITY OF FOUNDRY METALS.*

BY THOS. D. WEST.

[Concluded from last issue.]

Chemical Changes Due to Remelting.

Attention is called to the fact that this paper contains 162 analyses, ten specific gravity tests and several fracture views which have all been made and kindly furnished by Dr. R. G. Moldenke.

In taking up a study of Table No. 4 we are first struck by the increase of total carbon. We find that starting with the original pig containing 3.94 carbon, four remelts increased it to 4.76, an increase of nearly one per cent. It is to be noted

TABLE 6.—COMPARATIVE FUSION TEST OF CAST IRON WITH OPEN HEARTH STEEL.

Heat Nos.	21	22	23	24	25	26	27	28
Kind, weight and form of metal charg'd each size.	35 lbs. of iron and steel in block form.	29 lbs. of iron and steel in block form.	23 lbs. of iron and steel in block form.	61 lbs. of iron and steel in scrap form.	44 lbs. of iron and steel in block form.	52 lbs. of iron and steel in scrap form.	40 lbs. of iron and steel in block form.	58 lbs. of iron and steel in block form.
Blast put on.....	8:56	2:50	3:00	11:30	3:23	10:37	11:29	3:26
Steel running.....	9:09½	2:59⅛	3:05	11:41¼	3:32	10:45¼	11:38¼	3:31
Iron running.....	9:06¼	2:58	3:04	11:38	3:30½	10:45	11:36¾	3:32¼
Steel all down.....	9:21	3:08	3:11¼	11:51	3:41½	10:58½	11:49¾	.....
Iron all down.....	9:17½	3:05½	3:10	11:48	3:40	10:58	11:49	.....
Iron exceeded steel in starting..	3m.	1m. 30s.	1m.	3m. 15s.	1m. 30s.	45s.	1m. 30s.	15 s
Iron exceeded steel in finishing	3m. 30s.	2m. 30s.	1m. 15s.	3m.	1m. 15s.	30s.	45s.	....

that in all cases the sand or gray rolls show more carbon than the chilled roll.

The next feature of importance is the relative proportions of graphitic and combined carbon in the sand and chill roll remelts. We find that by changing the rate of cooling the same iron can produce one casting holding the carbon in a graphitic form as high as 3.16, while another casting from the same ladle has practically no graphite in its composition, but

TABLE 7.—CHEMICAL ANALYSIS OF GRAY CAST IRON AND OPEN HEARTH STEEL RE-MELTS.

Heat Nos.	21		22		23		Analysis of metal obtained from the 23d heat.		Analysis of metals charged in heats Nos. 24 to 26.	
Kind of metal charged.	Gray cast iron.	Open-hearth steel.	Gray cast iron.	Open hearth steel.	Gray cast iron.	Open-hearth steel.	Gray cast iron.	Open-hearth steel.	Gray cast iron.	Open-hearth steel.
Analysis letter.	L	M	N	O	P	Q	R	S	T	U
Total carbon.....	4.02	.60	.....	1.48	.....	2.74	4.60	3.05	4.20	.70
Graphite carbon ..	2.90	.....	.....	.....	.....	.....	3.30	.15	3.03	trace
Combined carbon ...	1.12	.60	.....	1.48	.....	2.74	1.30	2.90	1.17	.70
Silicon.....	1.72	.31	.....	.26	.....	.14	1.15	.35	1.24	.38
Sulphur....	.03	.026	.....	.10	.....	.14	.10	.18	.05	.12
Mang'nese	.35	.34	.....	.23	.....	.15	.23	.06	.40	.59
Phosph'us.	.073	.106	.....	.167	.....	.190	.103	.196	.092	.119

holds the carbon mostly in a combined form, as is seen in columns J and K, Table 4. The writer would call special attention to the difference existing between the gray iron and chilled roll carbon determinations. This would not bear out the claim that no difference exists in the chemical composition of the gray and chilled portions of the same casting. We next come to the silicon, sulphur, manganese and phosphorus.

We find these are all in line with the varied experience of those who have kept close watch of results obtained by remelts, to the effect that silicon and manganese decrease while sulphur and phosphorus increase. It may cause some surprise that more silicon was not lost or sulphur added than shown by the four continuous remelts in heats 9, 10, 11 and 12 Table 3. The only way the writer can account for this is that the metal was not held very long in the cupola during the melting process compared to the time generally occupied in ordinary shop practice, in which a charge of iron is something like an hour in passing down from the charging hole to be tapped out as fluid metal. In the heats shown, Table 3, the iron is not exposed to the effects of the blast and gases longer than 24 minutes and in most cases only from 16 to 18 minutes. When we consider that the longer iron stays in contact with incandescent fuel or is exposed to gases, the more sulphur will be absorbed up to the limit of the iron's affinity for it, we can readily reason out why the increase of sulphur is not more than that shown. The reverse is true of silicon; the longer iron is exposed to the effects of the heat and blast, the more silicon is lost.

Semi-Steel Castings.

Regular steel requires longer time to fuse, than is necessary for cast iron, as will be seen by Table No. 6 in which heats Nos. 21, 22 and 23 are continuous remelts of the same metals. The steel was a "riserhead" piece of scrap that was molded to make a single piece of cast iron of the same form so that conditions as to form and weight could be the same for both metals in making the comparative fusing test shown.

Heats 24, 25, 26 and 27 are two remelts of different quantities of cast iron and steel metals, having similar composition, as will be noted by referring to columns T and U, Table 7.

Heats 24 and 26 had the metals in scrap form as nearly alike in size and bulk as they could be roughly made and when melting they ran into molds to give blocks two and a half inch by four inch by six inch, so as to insure a uniform size of stock for making the comparative heats 25 and 27. Heat 28 was a remelt of the blocks obtained from heats 25 and 27. This heat, it will be noticed, had the iron and steel come down closely together. The reason the closing time is not shown is on account of stopping up the tap holes after the iron had started to run, with a view to catching metal in a hand ladle to pour shrinkage and contraction tests, which left the matter too indefinite to record the time of actually finishing first, although, as near as we could see or judge, they ended closely together. It will be noticed by a study of Table 6 that the more we remelt scrap steel the less difference exists in the iron starting and closing ahead of the steel. This is no doubt due to the fact that remelting steel raises its carbon and at the same time we find that steel remelt will be very spongy or filled with gas or blow-holes, which increase more in size and number with each successive heat, thus causing the steel product to be very porous and thereby permitting the heat to better penetrate its body and bring it quicker to a fluid state.

Table 7 plainly shows the uselessness of trying to remelt steel and obtain from it the original metal, as can be done with cast iron. Nothing has led founders on more wild-goose chases than giving ear to some of the high-sounding claims made for remelts of steel or its mixture with cast iron. It is true that steel scrap mixed with cast iron can strengthen the latter to a limited degree, but the extreme claims some make for it and for its mixture are erroneous and unfounded. We have no metal that will deteriorate from its original state by reason of remelting, so much as steel scrap. The action taking place in remelting steel in a cupola increases the carbon in the metal, as shown in Table 7. We find that the first remelt raised the carbon from .60 to 1.48; the second sent it up to 2.74 and the third to 3.05—an increase in either of these three remelts sufficient to show we are very far from retaining anything like the original steel in any remelts in a cupola, which compels the steel to be in contact with the fuel from which it absorbs the carbon with avidity.

When steel is melted in a reverberatory or air furnace in mixture with cast iron, we have more favorable conditions, because of its being possible to keep the carbon down and add other metals, as spiegel and ferro-manganese, which alloy with the fluid metal without having their original properties destroyed to any large degree. Tensile strengths ranging

*Read at the Fall meeting of the Western Foundrymen's Association at Cincinnati, O., Oct. 20, 1897.

from 45,000 to 50,000 lbs. per square inch, have been obtained by air furnace meltings with mixtures of steel, iron, etc., but to obtain castings equal to those of steel proper, we must have them cast by regular steel founders. Wherever we desire to improve the strength of cast iron by mixture with steel, the lower carbon steels will be found to give the best results, and air furnace meltings excel those of a cupola, especially if charcoal irons are used. In mixtures with the latter, from 15 to 30 per cent of soft steel scrap may often be advantageously used.

Shrinkage, Contraction and Specific Gravity of Cast Iron.

Usually if a mold is poured short where the weight of metal has been figured, the first thought is that some mistake has been made in figuring the cubic contents or volume of the mold or ladle, and after all figures are checked over again and due straining and extra metal allowed for, and are still found correct, the question where the iron went is farther than ever from solution. Such a state of affairs is often met, and frequently causes heavy losses. For some time back the writer has felt that specific gravity and shrinkage of molten metal often have something to do with the question "Where

FIG. 6.—SHRINKAGE POURING TEST.

did that iron go to?" The writer's experiments in testing the comparative fusibility of metals, in handling different grades at the same time, have led him to the belief that here occurs a shrinkage of molten metal under certain conditions that we have not heretofore known or recognized. Realizing the advisability of measuring in some way this shrinkage, research was made without success, to find if any methods existed whereby the specific gravity of molten metal could be obtained, so as to make a comparison with the same when the metal had solidified. The writer then devised the following original method, which can not be called a specific gravity test, but more a measure for volume.

At M, Fig 7, is seen an iron pattern from which sand or chill molds may be made. At A, Fig. 6, is an iron box three inches square by 11 inches long in which the pattern has been molded to make a dry sand mold. This mold, as shown, is filled with hot molten metal. The cut shows a molder in the act of pouring the contents of the mold into a chill or all-iron mold. This is split in halves, as will be noticed, and a ring clamp, as at B, is used to hold it firmly together, E being a bottom block for the chill proper to rest on and D, a funnel cap placed loosely on the top of a chill to insure the stream of metal being guided directly into the chill mold without any being spilled. Before pouring these molds, they are tested to learn if their cubic contents for holding metal are exactly alike, by means of filling one with fine hour-glass sand and then pouring the same into the other. This is done only as a precaution to make sure no extra thickness of blacking or disortion of the dry sand mold had occurred in any manner while making it. There are three of these dry sand molds made for each cast or test of any one grade of metal, two being called portable and one stationary. The plan of using these molds is as follows: A portable mold is secured in the ladle shank and the cupola tapped to fill it direct, and it is then quickly poured into the chill mold as above described and seen in Fig. 6. This done, the first sand mold is removed from its ladle shank, and another set in to replace it. This, in turn, is again filled with metal and instead of pouring this into a chill, it is poured into the sand stationary mold, after which it is then removed and placed with its mate. We now have two molds, one a chill and the other a sand mold, that will have a sunken space at the neck K, Fig. 7. To learn the amount of shrinkage that has taken place, the shrunken spaces at the necks of the chills and the dry sand mold are now when filled with molten metal and then taken from the molds cold, and separated from the main casting, views of which pieces are seen at E and H, Fig. 7. The straight portion or

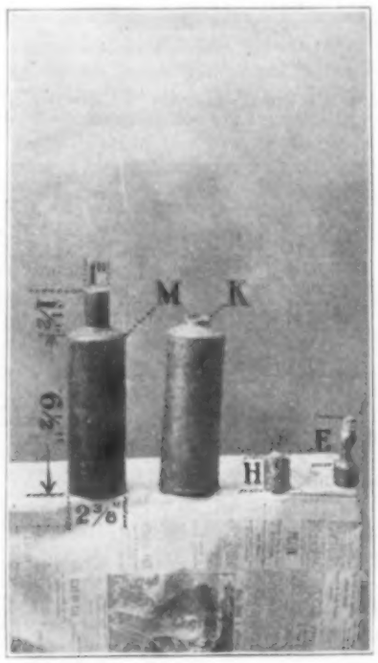


FIG. 7. SHRINKAGE PATTERN AND TEST CASTING.

H is that created by the shrinkage, which takes place as the metal is being poured before the mold is filled; and the portion at E, which is irregular in outline, is that created by the shrinkage of the molten metal in cooling to a solid after the molds have been poured or filled. A little study of the sections E and H will show that their total weight (by fine apothecary scales), minus any thin wafer sheets of iron that might be found sticking to the walls of the dry sand mold that had not run out as metal to test the shrinkage, would be the shrinkage of that iron under the conditions in which it had been poured. Table 8 gives the shrinkage of a number of metals which the writer ran specially to test the subject of shrinkage and contraction and which were mostly distinct heats from those shown in Tables 3 and 5 making all told, 24 heats described in this paper.

By referring to the following table, it will be seen we have in castings measuring about two and a quarter inches diameter by seven inches long (the actual form and size being seen at M, Fig. 5), weighing nearly eight pounds, a shrinkage in the chilled iron of about six ounces, and in the gray about two ounces. This means a shrinkage of about four and a half lbs. per hundred for the all-chilled iron or rolls, Fig. 2, and nearly two lbs. per hundred for the gray iron or rolls, Fig. 1. In larger figures, for a 20-ton casting, the table would imply a shrinkage of about 1,800 pounds for chilled iron, were it

possible for all of its body to be as thoroughly chilled as are the rolls seen in Fig. 2, and 800 pounds for the gray iron if the total body of the casting does not get up in graphite any higher than the rolls hold it, as seen in Fig. 1.

It is to be remembered that the tests of iron shown in Table 8 do not include an iron as soft as is necessary for stove plate or very light castings, and because such grades of iron are softer than any shown in Table 8, it is to be said that such softer grades would not have the shrinkage that is shown above. Because we generally run this iron into very thin castings we have reason to expect that the shrinkage of the molten metal, in pouring such work as stove plate, etc., will be greater in ratio than the irons noted in Table 8, when poured into heavy castings. The part at H, Fig. 7, exhibits the shrinkage that takes place as the mold is filling up, while E is the shrinkage that takes place after the mold is filled and the iron solidified. The latter is also shown by the shrinkage hole at the right of Fig. 3, which is chilled iron made from the same ladle that the roll on the left of Fig. 3 was poured from, and which does not exhibit the internal shrinkage shown in the chilled roll, because of being allowed a longer time to cool, being cast in a green sand mold. The shrinkage exhibited by the irregular outlined body, at E, right of Fig. 7, which leaves shrink holes in castings similar to that shown in the chilled roll at Fig. 3, is always to be found in that part last to solidify, as the part first to solidify draws from it metal to supply its shrinkage. If this is kept in mind, it will assist the founder to obtain solid castings and overcome many difficulties and losses often incurred by the

TABLE 8.—SHRINKAGE AND CONTRACTION OF GRAY AND CHILLED IRONS.

Heat Nos.	29	30	31	32	33	34
Character of metal tested.	Ferro-silicon.	Foundry iron.	Bessemer iron.	15% steel with gray iron	Charcoal iron.	Charcoal iron.
Silicon	12 25	1.75	1.72	1.61	.75	.70
Sulphur.....	.021	.04	.054	.055	.03	.035
Shrinkage of chilled iron..	3 oz. 240 gr.	2 oz. 240 gr.	2 oz. 180 gr.	2 oz. 290 gr.	6 oz.	6 oz. 280 gr.
Shrinkage of gray iron.....	3 oz	1 oz. 210 gr.	1 oz. 140 gr.	....	1 oz. 460 gr.	2 oz. 120 gr.
Contraction of chilled iron..	.270"	.262"	.271"	.322"	.446"	.460"
Contraction of gray iron.....	.24 "	.205"	.2 1"	.227"	.329"	.235"

shrinkage of iron. As an example, the writer would cite a case of the casting of a locomotive pump weighing about 200 pounds that nearly went the rounds of all the founders in a large city some years back, all trying their hands at getting a solid casting. The trouble lay in that there was one part of the casting which had a valve seat bearing in it much heavier than other parts of the casting, which, if not found solid, condemned the casting. It is safe to say that half a hundred of these castings went to the scrap pile before a good one was obtained. As the different shops tried them they would be made in dry sand, skim gated, cast on end and made in most every conceivable form known to founding until finally the writer was asked to try his hand at it. After studying the design of the pump, the writer soon saw that making it in dry sand or anything else combined with casting on end and skim gating it to death would not help matters. If it had been simply molded in green sand after common fashion, and a feeding head or riser had been set right directly on the valve or heavy portion of the casting, large enough to insure the metal in the riser being held in a liquid state longer than that in the valve portion of the casting, no more trouble would have been experienced. By using this plan the writer had no difficulty in making the pump casting solid. An adoption of the principal just outlined can save many castings that to-day are giving many founders trouble and losses. The tests exhibited by the cuts at Figs. 3 and 7 and Table 8 demonstrate that metal will shrink to cause trouble by leaving holes in the interior of castings as well as deceiving a founder as to the amount of metal he should have to pour a casting, and also that we are to expect the greatest shrinkage in the harder grades of iron. The shrinkage exhibited by the 12 per cent or ferro-silicon iron at heat No. 29 Table 8, surprised the writer in being so high.

Contraction.

There are two distinct actions that control the cooling down of molten metal to a cold state, which are so different and definite in their effect on the strength of castings, that we should by all means have different terms to designate them. For this reason the writer has accepted the terms "shrinkage" and "contraction." Tersely stated, "shrinkage" implies the action taking place when the metal is being poured and after the mold is filled, in its cooling down to a state of first solidification, causing holes in castings. The term "contraction" includes that action occurring after the liquid metal has solidified, to cause castings to be smaller in their dimensions than those of the pattern from which they were molded. Each of these actions is distinct in its power to influence the strength of castings, which cannot be better displayed than in the bursting of fly wheels. The shrinkage will often have left cavities where the arms join the rims and the contraction makes trouble because of the internal strains caused by the difference in rate of cooling betewne the heavier rims and the lighter arms. Light bodies contract much more than heavy ones, to such a radical degree, that, for an example, a section one-half inch by two inches, 14 feet long will have as much again contraction in the length of its body as a section four inches by nine inches,

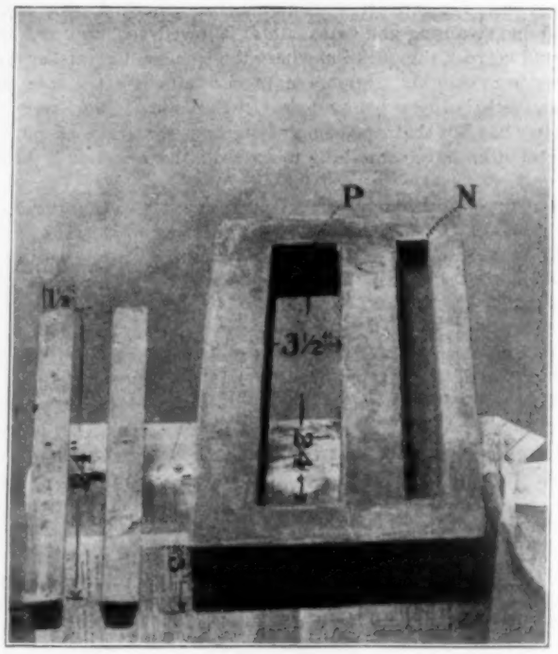


FIG. 8. CONTRACTION CHILL AND SAND TEST MOLDS, WITH PATTERNS.

same length. This is well displayed in the few contraction tests seen in Table 8. We find here that tests No. 1 and 6 give us the mean of .127 greater contraction for the fast cooled bars than for the slow cooled ones, each of the same cross section and length, patterns for which are seen in Fig. 8.

The greatest difference in Table 8 is .225 and the smallest .030. It is to be remembered that the respective tests seen in Table 8 were cast in their order with the same gate and hand ladle of iron. The cause of such a difference in the contraction of two bars is, as will be seen by Fig. 8 at N, that one is cast in a chill mold and the other in sand, P being the space for molding the sand bar. A study of the difference in contraction which the rate of cooling can cause by the device seen at Fig. 8 is instructive in more ways than one. Take the case of the charcoal iron heats, Nos. 33 and 34, which will illustrate the great difficulties the makers of chill rolls, etc., are confronted with. Here we find that the chilled part of the casting will have as much again contraction as the body of the casting that is not chilled. It is no wonder that chill roll makers experience much trouble with the checking and cracking of the surfaces of chill rolls, due to the excessive contraction of the chilled part, which must leave or pull away from the chill mold, supposed to support its enclosed body of liquid metal, long before it has solidified and which by reason of its head pressure, incased within the body of the shell which has contracted from its chill or outer support, must be heavily strained to retain its enclosed body of still fluid metal. Another matter which the few chill and sand contraction tests seen in Table 8 show is the urgent necessity of our maintaining as perfect a uniformity as possible in the "temper" and nature of sands for molding test bars which are expected to truly record the contraction or other physical qualities of cast iron. We can see by the chill and sand contraction tests herein recorded how a very slight difference in the dampness or nature of molding sand can effect the contraction of test bars. The smaller they are the worse, of course, are they distorted, preventing a true comparative record of the actual conditions which prevail. The irregularity that must exist in the temper and nature of molding sand has suggested the idea that it may be best to use a chill instead of a sand mold for testing the contraction of iron, as, at the best, the utility of test bars is only for comparisons.

Attention is again called to the specific gravity tests seen

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in Table 4, which, in four successive remelts, raised the density of the iron from 7.01 in the gray to 7.46, an increase of .45 in density, and in the chilled iron to 7.79, an increase of .78 from the original pig, showing that successive remelts greatly increase the density of irons. Another point to be noticed is that the chilled iron differs about .30 in density from the gray iron in the respective heats shown. In testing the density of these irons by immersion in liquid metal, they exhibited conditions which show that with the same hand ladle of metal we could make two castings, equal in volume, one of which would sink like a stone, and stay down, and the other float (like a piece of ice on water), by means of chilling one piece and casting the other in sand. Such a test proves that the specific gravity of solid iron and that of the same iron in a liquid form can differ to a radical degree.

Why Iron Chills.

At a meeting of the American Chemical Society, Troy, N. Y., last December, the president, Dr. C. D. Dudley, in his annual address asked "Who will first completely investigate the relation between the chemistry and the chilling properties of cast iron?" The writer believes this paper embodies experiments and results which point to a solution of the problem, and which are as follows:

Chilling of cast iron is caused by the rapid solidification of molten metal, preventing the chemically combined or hardening carbon which exists in it as such, from changing to graphite, and thus giving a granular structure to solidified iron. This it would do, if the iron solidified more slowly. Some irons will not chill, because they are so high in silicon and low in sulphur or other hardening elements, that the carbon in the molten metal is forced out of its chemically combined form, into graphite or free carbon, according to the rapidity with which the molten metal loses its initial heat or fluidity.

It will be noticed that the above definition refers to the combined or hardening carbon, which exists "as such" in molten metal as taken from the cupola. This implies that the carbon may exist in some other form than that of chemical combination with the molten iron, which is, of course, contrary to the general acceptation, as authorities hold that the carbon in molten metal is all permanently chemically combined with the iron until it has solidified. In the light of the writer's recent researches, he is led to differ from these authorities and claim that the carbon is not always held in a chemically combined form with the molten metal. There are two phenomena shown in actual furnace work and founding, that the writer believes sustain the position he takes. One is based on the fact that the hotter or more fluid we pour metal, the deeper it will chill, a phenomenon first brought out and proved by the writer in other papers. The other fact is to be observed in making soft grades of iron at the blast furnace, where free carbon, or "kish" will often be seen to rise continually to the surface of the molten metal as it cools off, sometimes to such a degree as to fairly cover everything around the pig beds, or ladles of iron, with its flakes, which often act and look like fish scales that have been scattered by the wind. If we accept the hypothesis herein presented, that all carbon does not invariably exist in a chemically combined form in molten metal, it is then a very easy task to explain why a hot iron should chill deeper than a dull iron, and why graphite often should be seen to rise continually to the surface of liquid metal in soft grades. It is also well to state that the cooler the molten metal becomes the more it evolves the carbon to graphite. This is once in a while noticeable in the foundry in the remelting of soft iron, but to see the plainest demonstration, it is necessary to visit the blast furnace when making soft or No. 1 iron, which is of course high in silicon and as a rule low in sulphur. If any one cannot accept the writer's reasoning on this subject, he must, to differ from him, first show where the graphite or free carbon comes from in the making of soft iron and why there is a greater escape of the free carbon the duller the iron becomes, and again, why it is that a hot iron will chill deeper than one poured dull.

INDUSTRIAL SUMMARY.

New Buyers in the Market, and Some of Their Wants:—

[If you are in need of machinery of any description, please notify *The Iron Trade Review*, and we will put you in communication with our advertisers at once.]

The Consolidated Pneumatic Tool Co., 11 Broadway, New York City, has been incorporated under the laws of New York, capital $150,000, to manufacture and deal in pneumatic tools and air compressors. It has bought the pneumatic tool plant of Wm. Wolstencroft's Sons & Co., at Frankford, Philadelphia, Pa., the patents of the Wolstencroft pneumatic tool, also all the patents of the Keller pneumatic tool heretofore made by the C. H. Haeseler Co., of Philadelphia. The directors and officers are: John Evans, Peter Gray, O. W. Norcross, H. B. Torrey, Geo. Cohen, Geo. Hartford, and W. P. Pressinger. President, Peter Gray; vice-president, Geo. Hartford; secretary, W. P. Pressinger; treasurer, John Evans, and general manager, Geo. Cohen. The tools will be made at the factory in Frankford.

The Southern Iron & Structural Works, Birmingham, Ala., will buy a punch, shear and lathes.

The Anniston Pipe & Foundry Co., Anniston, Ala., is in the market for electric motors for driving cranes, blowers and other machinery, for 200,000 vitrified shale and fire brick and for electric cranes and other foundry equipment.

Dietz, Schumacher & Boye, Cincinnati, will purchase a 10-ton traveling crane, 30-foot span, for the addition they are to build.

Poulterer & Co., Philadelphia, will buy an upright second-hand hoisting engine and boiler.

The Economy Foundry & Machine Co., of Syracuse, N. Y., has been incorporated to manufacture gray iron castings and patterns for castings. Capital, $40,000, and directors, Slater Laycock, Frank A. Austin and William H. Brown.

The Pearer Mechanical Stoker Co. has been incorporated at Chicago, with a capital stock of $10,000, by John F. Hale, George W. Patterson and A. M. Morse.

The King Annealing Process Co. has been incorporated at Bulleville, Ill., with a capital stock of $10,000, for annealing castings. The incorporators are: Richard King, Robert Rogers, Sr., and Charles G. Rogers.

The Rosenthal Stieht Co. has been incorporated at Chicago, with a capital stock of $2,500, to manufacture ornamental iron and brass, by John H. Stieht, Lewis V. Seydel and Frank G. Gabel.

New Construction:—

Dietz, Schumacher & Boye, of Cincinnati, have decided to go forward with the building of their new factory, on the corner of Queen City ave. and Buck st., and have already let the contract for the stone work. The building is to be of stone and brick, 90 ft. by 180 ft. The work is to be pushed forward as rapidly possible the weather permitting, and the company hope to occupy it by spring.

New buildings are to be erected at Birmingham, Ala., by the newly incorporated Southern Iron & Structural Works, capital $20,000. There will be a foundry, 70x75 feet; a machine shop, 40x75 feet; and a wire works shop, 25x100 feet. The products will be structural iron work and wire.

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SAN FRANCISCO, John Woodlock, 26 Beale St.

It is reported that work will soon begin on the new rolling mill plant to be built at Scottdale, Pa., by the company composed of ex-employes of the Scottdale Iron & Steel Co., and their friends. Of the $125,000 pledged, the first assessment of 20 per cent has been paid in. The board of directors consists of A. L. Keisrer, J. W. Ruth, A. C. Overholt, J. S. Parker, and M. A. McCombs, of Scottdale, and P. F. Cann and James A. Bennett, of Greensburg.

Barry Bros., of Toledo, O., have the contract to furnish the chemical plant to be erected at the Weston Furnace Co.'s charcoal furnace, Manistique, Mich.

At Anderson, Ind., the new foundry owned by Alex. Jones, T. J. and Arthur Morgan is about completed.

The new plant of the Reading Car Wheel Co., Reading, Pa., is in operation. Electrical power is used throughout. The molding department is a steel building 94x155 feet. The cupola building connected with it is two stories and 40x80 feet. H. H. Hewett, who is also president of the Union Car Co., of Depew, N. Y., is president.

A Sharon, Pa., dispatch says that State Treasurer Haywood has donated a site for the proposed tin plate plant at that place and will be a stockholder in the company.

The Missouri, Kansas & Texas Railroad is erecting 12 new buildings at Sedalia, Mo., for its shops. All the buildings are of brick, and they include a freight car shop, one story, 110x224; passenger paint shop, one story, 124x150; varnish shop, one story, 40x150; stock room, two stories, 40x55; machine shop, one story, 60x77; blacksmith shop, one story, 60x123; engine and boiler house, one story, 50x100; wood mill, two stories, 80x150; passenger erecting shop, one story, 100x146; store room, two stories, 40x80; dry kiln, one story, 25x40; lumber shop, 50x100. The plant will cost, when finished, $100,000. J. A. Daly, Nevada, Mo., has the general contract for the work.

The machine and repair shops of the Central Railway, of Georgia, at Columbus, Ga., recently destroyed by fire, are to rebuilt at once, at a cost of $100,000.

The contract for building the new factory for the Badger Brass Mfg. Co., at Kenosha, Wis., has been let to Holderness & White. The building, exclusive of machinery will cost over $10,000.

It is reported that the Caldwell & Peterson Mfg. Co., of Wheeling, W. Va., manufacturers of roofing, will erect a new building.

Work will begin at once on the new plant of the Anniston Pipe & Foundry Co., at Anniston, Ala. It will be larger than the plant which burned and complete new equipment will be purchased.

The Brownell Car Co., of St. Louis, is about to resume under the trustee, having a number of car orders in sight.

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123 AND 125 WATER STREET, **PITTSBURG, PA.** 124 AND 126 FIRST AVENUE.

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Some SECOND-HAND TOOLS in stock.

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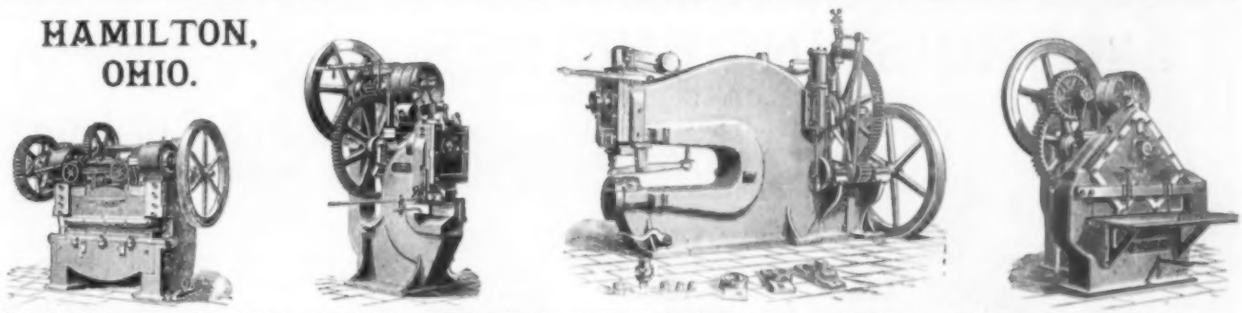


MANUFACTURERS AND EXPORTERS OF **POWER PUNCHING AND SHEARING MACHINERY** ADAPTED TO ALL PURPOSES FOR BOTH HEAVY AND LIGHT WORK.

Additions, Enlargements, Removals, Etc.:—

The Western Malleable & Gray Iron Mfg. Co., of Port Washington, Wis., is reported to have secured a site at Milwaukee, and to be arranging for the removal of the plant to the latter city. Three or four new buildings are to be erected at once.

The Collins Co., of Collinsville, Conn., in order to better its facilities, is making extensive improvements. The contract has been taken by the Berlin Iron Bridge Co., of East Berlin, Conn., for a large addition to the forge shop. The new construction will be entirely of iron, in order to have it fire-proof, no wood work being used in the construction.

The Mechanics' Foundry Co., Rockford, Ill., will shortly erect a modern brick foundry building as an addition to the present plant.

The Coronet Steel Co., of Catasauqua, Pa., which recently acquired the plant of the Catasauqua Mfg. Co., will enlarge and improve the plant to make steel castings, ingots, blooms, billets, bars, rods and plates.

The Humbert Tin Plate Co., South Connellsville, Pa., talks of increasing its works to a six-mill plant. The mill buildings and machinery were originally planned for such enlargement.

Fires and Accidents:—

At Quincy, Ill., the Bonnett & Nance Stove Foundry burned down, Oct. 27. Loss, $60,000; insurance $50,000.

The loss to the Thompson Mfg. Co., of Cleveland, roofing manufacturer, by its recent fire was about $20,000; mostly covered by insurance. New quarters have been provided and manufacturing is being continued.

The Clark Foundry & Machine Co., Knoxville, Tenn., lost its pattern building by fire Oct. 16. Loss $5,000; no insurance.

The Pencoyd Iron Works, A. & P. Roberts Co., makers of structural material, are now rolling 24-inch beams.

General Industrial Notes:—

The Pennsylvania Steel Co. is reported to be arranging to provide fresh working capital. There are in the treasury $1,000,000 of bonds, reserved for the purpose, but there has been no possibility of selling them at a fair price. The company has large orders which will yield a margin of profit, and the directors are considering a plan for raising money, which they will submit to the stockholders.

H. Silberman & Co., of Cleveland, scrap iron dealers, have removed to 192 to 216 Scranton ave., formerly occupied by Schwarzenberg Bros. & Co. They will retain their yard at 580 to 600 Canal st., as a branch yard.

As stated by the *Register*, the pay rolls of the Kelly Nail & Iron Co., of Ironton, O., for the three months ending Oct. 23, were $15,000. From Aug. 1 to Oct. 23, 1894, they were $2,600, in the same period of 1895, $3,200, and in the like period of 1896, $4,400.

Sharpsville Furnace at Sharpsville, Pa., is to be started up at once by Pierce Bros. A conversion deal is said to have been made.

The Reading (Pa.) Iron Co. has posted notices of an increase in wages of all its employes, about 2,800. The increase varies in different departments, but will average five per cent.

The Indiana Iron Co., Muncie, Ind. is establishing a water works and fire system, with wells holding 100,000 gallons. The company now has 12,000 acres of gas leases with 20 gas wells. The nut and bolt department has been considerably extended.

The *Railway Age* reports car and locomotive orders, placed and prospective, as follows: The Omaha, K. C. & Eastern has ordered 10 locomotives from the Baldwin Locomotive Works; the Brooks Locomotive Works have an order for 12 locomotives from the Kinshin Ry., of Japan; the A., T. & S. T. Ry. has placed an order with Wells & French Co. for 100 refrigerator cars, and later will buy some furniture cars; the S. Carolina & Georgia Railroad has given the Ohio

Falls Car Co. an order for 100 flat cars; it is reported the Chicago Great Western has ordered 300 box cars from Haskell & Barker Car Co.; the Norfolk & Western is asking bids on 300 to 500 box cars; the Seaboard Air Line on 450 box and 200 flat cars; and the J. H. Somers Fuel Co., of Cleveland, on 200 coal cars; the A. T. & L. F. Ry. is building three postal cars at its Topeka shops.

The Fowler Cycle Mfg. Co., of Chicago, made an assignment Oct. 22 to the Chicago Title & Trust Co. The assets were estimated at $350,000 to $375,000, of which about $150,000 is "installment accounts." The largest creditors are Herman Baker & Co., of New York, and Morgan & Wright, of Chicago. The plant of the company was one of the finest of its kind in the country. The failure is attributed to the competition of cheap wheels, which necessitated a reduction in the prices of high grade wheels. The immediate cause was slow collections. The company has a capacity of 30,000 wheels a year.

Judge Lamson, of Cleveland, has ordered the sale of the entire plant of the Falls Rivet & Machine Co., Cuyahoga Falls, O., which has been operated for the past two years under the receivership of J. A. Long.

The Carpenter Steel Co., of Reading, Pa., has taken a contract to furnish the Government 2,000 13-inch armor projectiles, the half-ton kind used on the battleships, for which $370 each is to be paid, the first lot of 100 to be delivered within 90 days, and the remainder within nine months.

Fannie Furnace, at West Middlesex, Pa., is being prepared for blast. Pickands, Mather & Co., Cleveland, have had no connection with the furnace since it was blown out two years ago.

The foundry department of the Casey & Hedges Mfg. Co., boiler manufacturers of Chattanooga, Tenn., is now in operation.

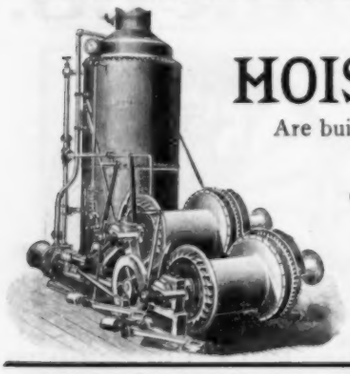
The M. F. brand of roofing plates, which is one of the most popular of Welsh ternes, will be manufactured hereafter by arrangement, at the plant of the Ellwood Tin Plate Co., Ellwood City, Pa.

Excursions to Chicago via Pennsylvania.

The Horse Show and Fat Stock Exhibition will be open at Chicago during first week of November. Low rate excursion tickets will be sold Nov. 1 to 6, both dates inclusive, to Chicago from ticket stations on Pennsylvania Lines; return coupons valid Sunday, Nov. 7.

Steam Yachts and Marine Machinery.

Also Towing Launches built by Marine Iron Works, Clybourn and Southport avenues, Chicago. Free illustrated catalogue. Write them for it.—*Adv.*



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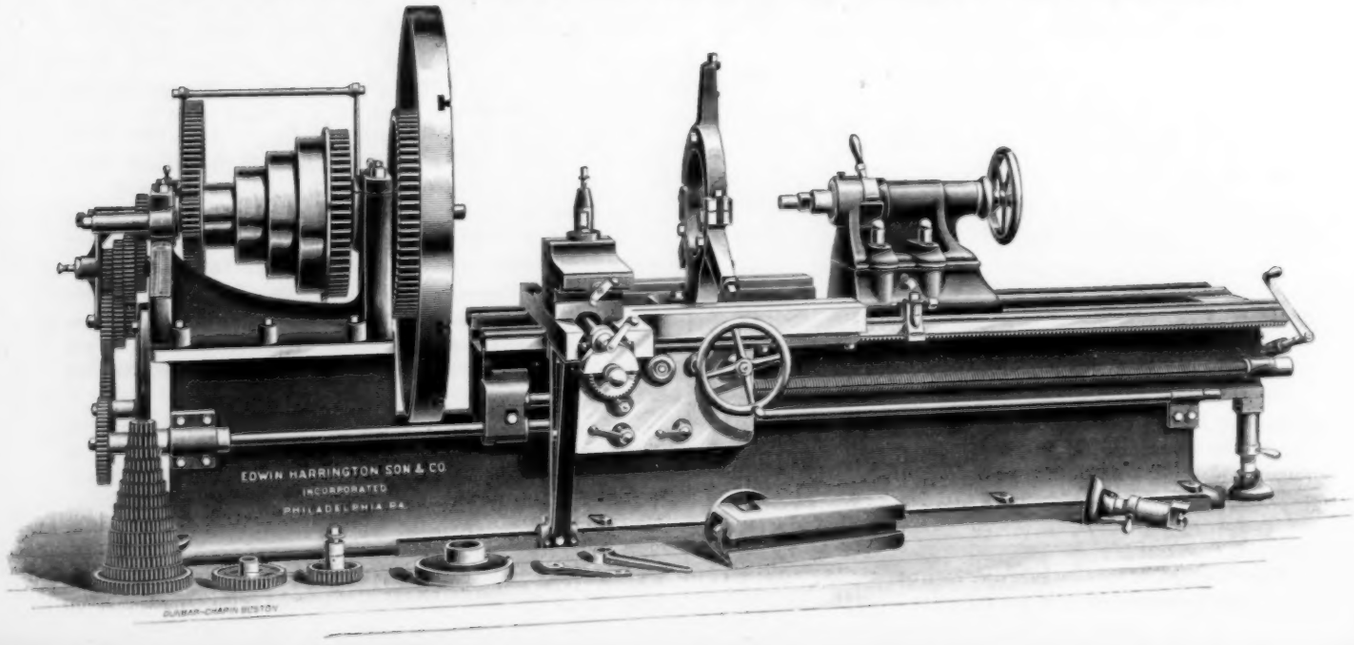

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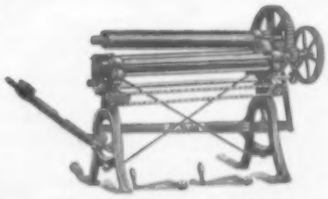

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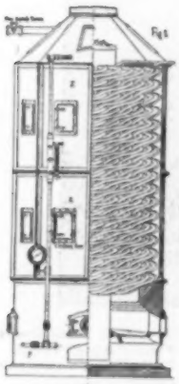
BROOKLYN, N. Y.



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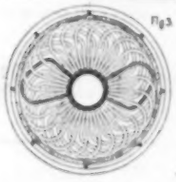

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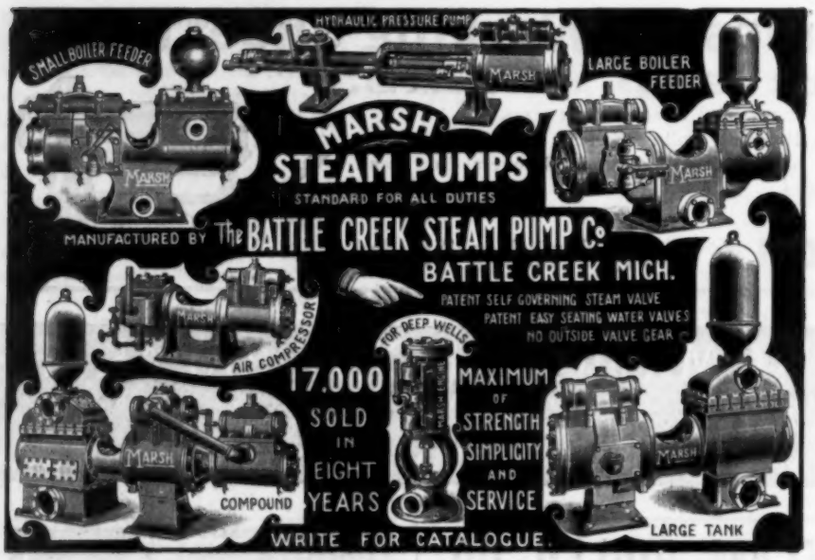

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Will be sent postpaid by *The Iron Trade Review* at $6.

Is a thorough revision of the list of blast furnaces, rolling mills, Bessemer and Open-Hearth steel works, plate and sheet mills, nail mills, tin plate mills, malleable, cast iron pipe and wrought pipe works, car wheel and locomotive works.

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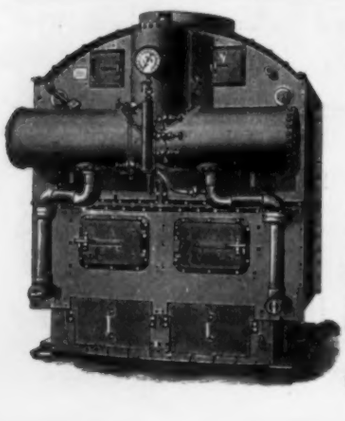

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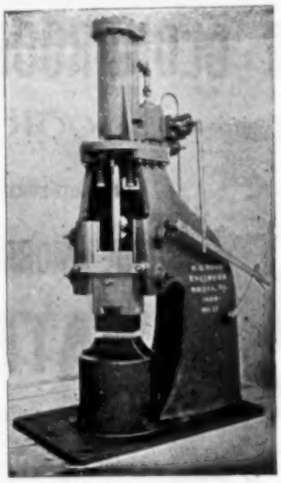

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Pittsburgh and Bellaire	† 7:00 am	†12:10 pm
Salem and Pittsburg	* 8:00 am	* 8:30 pm
Pittsburgh, Bellaire and East	† 3:15 pm	† 6:25 pm
Philadelphia and New York	* 1:40 pm	*11:25 am
Baltimore and Washington	* 1:40 pm	*11:25 am
Alliance and Pittsburgh	* 1:40 pm	*11:25 am
Ravenna and Alliance	* 5:00 pm	* 8:40 am
Philadelphia and New York	*11:10 pm	* 4:30 am
Baltimore and Washington	*11:10 pm	* 4:30 am
Alliance and Pittsburgh	*11:10 pm	* 4:30 am

Mt. Vernon and Pan-Handle Route

FROM CLEVELAND TO	LEAVE	ARRIVE
Xenia and Cincinnati	* 8:50 am	* 5:30 pm
Akron and Columbus	* 8:50 am	* 5:30 pm
Akron and Columbus	† 1:40 pm	†12:10 pm
Col. Cin. Ind. & St. L.	‡ 8:00 pm	* 7:30 am
Col. Cin. Ind. & St. L.	‡ 11:20 pm	.....

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Depot foot of So. Water St. City Office 241 Superior St.	Arrive.	Depart.
Valley Jctn. & Way Stations	*6:20 P M	*7:10 A M
Akron, Canton & Valley Jct	*10:00 A M	*3:30 P M
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Akron, Canton & Wooster, Defiance, Garrett, Marietta, Wheeling, Washington, D. C., and Baltimore	†2:25 P M	†11:00 A

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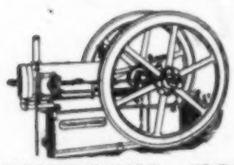

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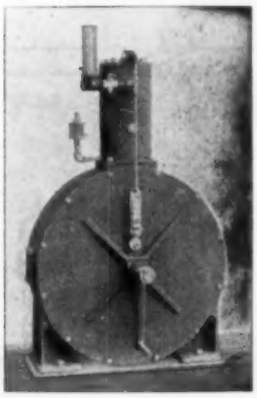

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RELIABILITY,
DURABILITY,
SIMPLICITY,
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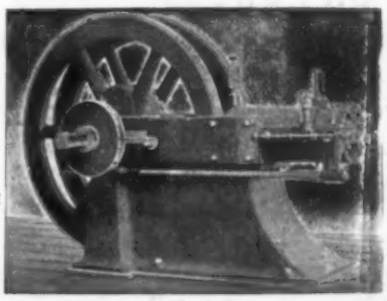

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The name of the Chicago, Milwaukee & St. Paul Railway has long been indentified with practical measures for the general upbuilding of its territory and the promotion of its commerce, hence manufacturers have an assurance that they will find themselves at home on the company's lines.

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Mines of coal, iron, copper, lead and zinc, forests of soft and hard wood, quarries, clays of all kinds, tan-bark, flax and other raw materials exist in its territory in addition to the vast agricultural resources.

A number of new factories have been induced to locate—largely through the instrumentality of this company—at towns on its lines. The central position of the States traversed by the Chicago, Milwaukee & St. Paul Railway, makes it possible to command all the markets of the United States. The trend of manufacturing is Westward. Nothing should delay enterprising manufacturers from investigating. Confidential inquiries are treated as such. The information furnished a particular industry is reliable.

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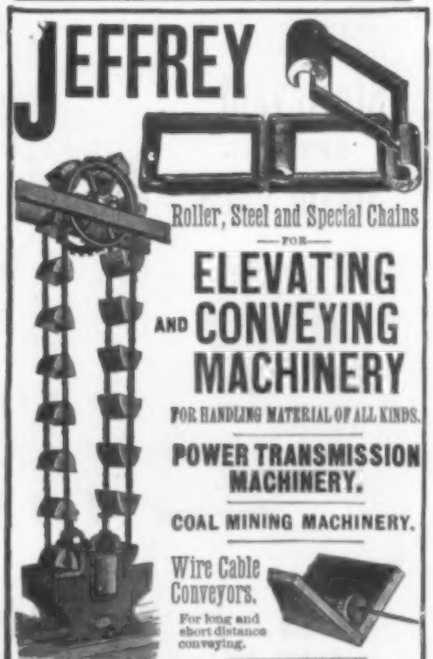

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ELEVATING AND CONVEYING MACHINERY
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COAL MINING MACHINERY.

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DREDGES, STEAM SHOVELS, EXCAVATING MACHINERY,
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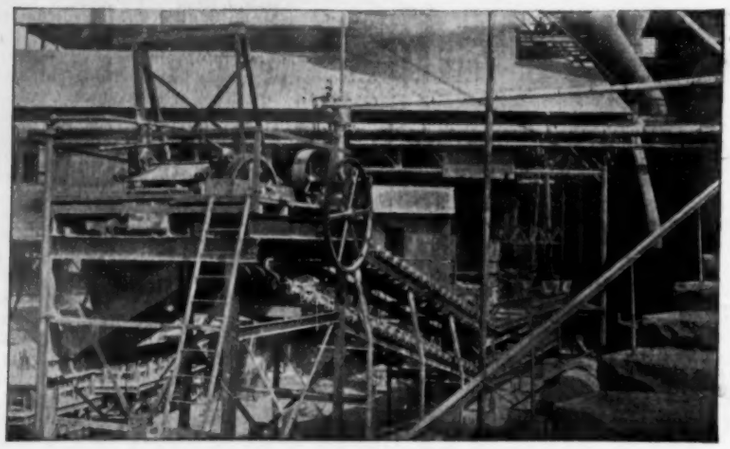
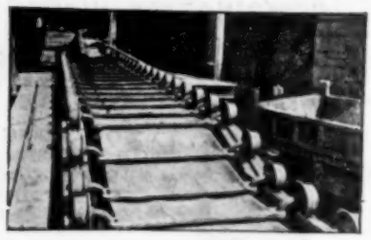
CENTRIFUGAL PUMPS, WITH SIMPLE, COMPOUND OR TRIPLE EXPANSION ENGINES.
PILE DRIVERS, WRECKING CARS, PLACER MINING MACHINES.



HOWDEN SLAG CONVEYOR AT CAMBRIA IRON CO.'S NOS. 1 AND 2 BLAST FURNACES.



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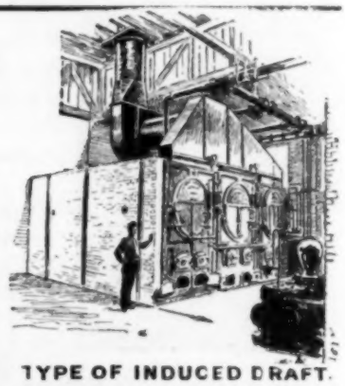

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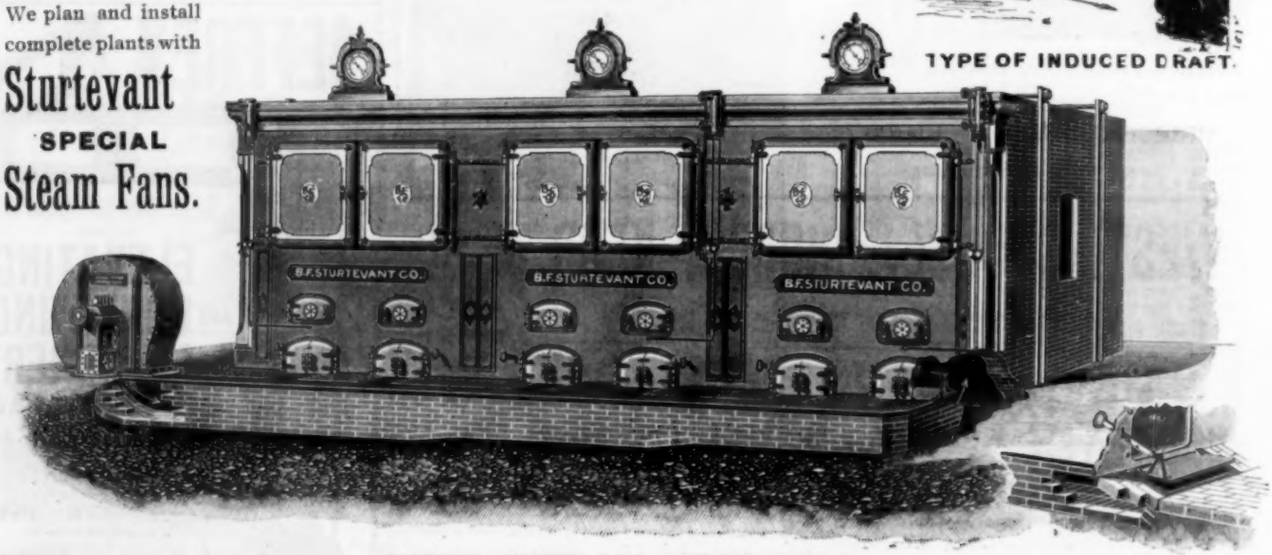

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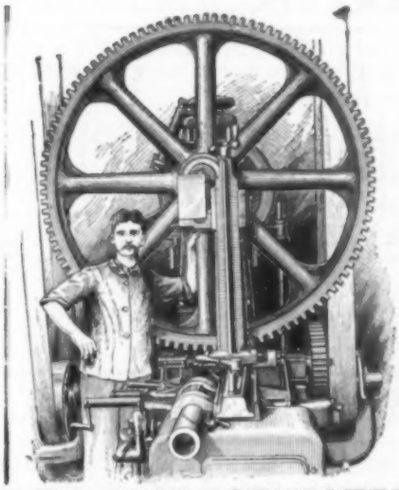

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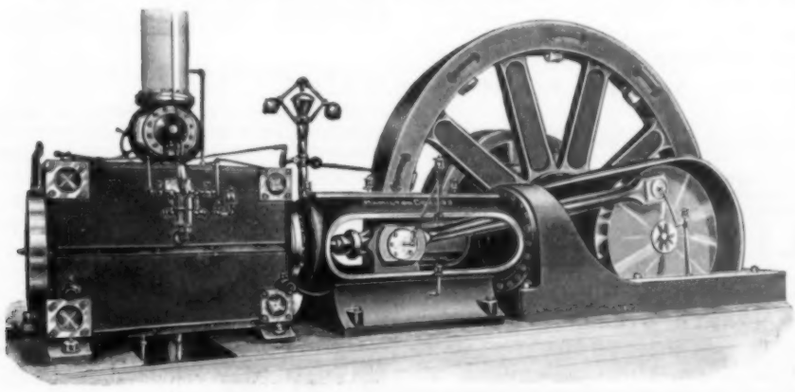

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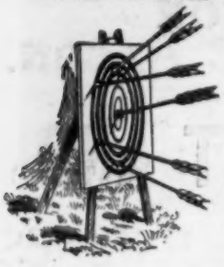

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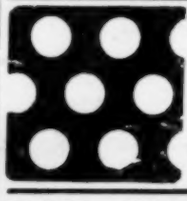

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Foundries—
Wm. Tod & Co., Youngstown, O.
Lorain Foundry Co Lorain O
Seaman, Sleeth Co., Pittsburg, Pa.
The Lane & Bodley Co., Cincinnati, O.
Hooven, Owens & Rentschler Co., Hamilton O
Fulton Steam Boiler Wks. & Fdy., Richmond Ind.
W. A. Jones Foundry Co., Chicago.
Jeffrey Mfg. Co., Columbus, O.

Foundry Supplies—
Clearfield Fire Brick Co., Clearfield, Pa.
Stuart Fire Brick Co., Pittsburg, Pa.
The Ohio Sand Co., Conneaut, O.
Jackson Sand Mining Co., Jackson, O.
Union Mining Co., Mt. Savage, Md.
Dover Fire-Brick Co., Cleveland, O.
Reese-Hammond & Co., Bolivar, Pa.

Forgings—
Cleveland City Forge & Iron Co., Cleveland
Bethlehem Iron Co., South Bethlehem, Pa.

Friction Metal—
Magnolia Metal Co., New York City.

Furnaces—
Brightman Furnace Co., Cleveland, O.
Playford Stoker Co., Cleveland, O.

Furnace Linings—
Union Mining Co., Mt. Savage, Md.

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W. S. Rockwell & Co., New York City.

Galvanizers—
Cleveland Galvanizing Works, Cleveland, O
Ætna-Standard Iron & Steel Co., Bridgeport, O.
Sidney, Shepard & Co., Buffalo, N. Y.

Gas Engines—
Charter Gas Engine Co., Sterling, Ill.
Pierce-Crouch Engine Co., New Brighton, Pa.
P. F. Olds & Son, Lansing, Mich.
Fairbanks, Morse & Co., Cleveland, O.

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Stilwell-Bierce & Smith-Vaile Co., Dayton, O.

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The Lane & Bodley Co., Cincinnati, O.
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Wm. H Wood, Media, Pa.

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Dietz, Schumacher & Boye, Cincinnati, O
Wm. Glader, Chicago, Ill.
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Cambria Iron Co., Johnstown, Pa.
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Marion Steam Shovel Co., Marion, O.

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W. H. Bosworth, Cleveland, O.
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Otis Steel Co., Cleveland, O.

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Bethlehem Iron Co., South Bethlehem,
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R. H. Stroud & Co., Chicago, Ill.

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W. H. Bosworth, Cleveland, O.

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Jenkins Bros., New York City.
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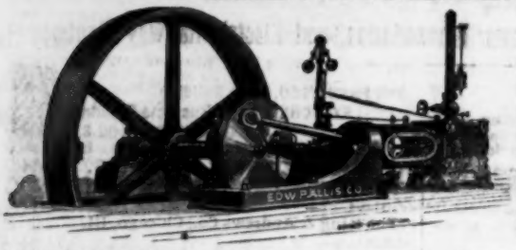

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IRON AND STEEL MARKETS.

IRON ORE.

[On Lake Erie docks.]

Special low-phosphorus hard Ore, Bessemer	$3.40@ 3.46
No. 1 Specular, Bessemer	3.05@ 3.17
No. 1 Bessemer hematite	2.60@ 2.90
Hematites No. 1 non-Bessemer	2.00@ 2.25
No 1. Specular, non-Bessemer	2.40@ 2.60

PIG IRON.

CLEVELAND (f. o. b. cars):	
Bessemer	$10 50@ 10 75
No. 1 Strong Foundry	10 65@ 10 75
No. 2 Strong Foundry	10 15@ 10 25
No. 1 Gray Forge, red short	... ... 9 75
No. 2 Gray Forge, neutral	9 90
No. 1 American Scotch	10 65@ 10 90
No. 2 American Scotch	10 15@ 10 40
Lake Superior Charcoal	12 25@ 12 50
PITTSBURG:	
No. 1 Foundry	$11 00@ 11 25
No. 2 Foundry	10 65@ 10 90
Gray Forge	9 75 10 00
White and Mottled	... ... 9 50
Warm Blast Charcoal	13 00@ 13 50
Cold Blast Charcoal	... ... 16 00
Bessemer	9 90@ 10 10
CHICAGO:	
Lake Superior Charcoal	$12 50@$13 00
Local Coke Foundry No. 1	11 50@ 12 00
Local Coke Foundry No. 2	11 00@ 11 50
Local Coke Foundry No. 3	10 50@ 11 00
Local Scotch Foundry No. 1	11 50@ 12 00
Local Scotch Foundry No. 2	11 00@ 11 50
Local Scotch Foundry No. 3	10 50@ 11 00
Southern Coke No. 1	11 00@ 11 25
Southern Coke No. 2	10 60@ 10 85
Southern Coke No. 3	10 35@ 10 60
Southern No. 1 Soft	11 00@ 11 25
Southern No. 2 Soft	10 60@ 10 85
Southern Silveries	11 25@ 11 50
Jackson Co Silveries	12 50@ 14 50
Ohio Silveries No. 1	@
Ohio Strong Softeners	12 00@ 12 25
Alabama Car Wheel	16 00@ 17 00
Malleable Bessemer	10 75@ 11 00
Coke Bessemer	11 50@ 12 00
CINCINNATI (reported by Rogers, Brown & Co.)	
Southern Coke No. 1, Foundry	$ ... 10 00
Southern Coke No. 2 and No. 1 Soft	9 50@ 10 00
Hanging Rock Coke, No 1	12 00@ 13 50
Hanging Rock Charcoal No. 1, Fdy	14 50@ 15 50
Tennessee Charcoal No 1	12 50@ 13 00
Jackson County Silvery No 1	12 50@ 13 00
Southern Coke, Gray Forge	8 25@ 8 50
" " Mottled	8 25@ 8 50
Standard Georgia Car Wheel	14 25@ 15 00
Tennessee " "	13 00@ 14 00
Lake Superior " "	14 75@ 15 25
BUFFALO:	
No. 1 Foundry Strong Coke Iron Lake Superior Ore	... ... 11 25
No. 2 Foundry Strong Coke Iron Lake Superior Ore	... ... 10 75
Ohio Strong Softener No. 1	... ... 11 75
Jackson Co. Silvery No. 1	... ... 14 00
Lake Superior Charcoal	... ... 15 50
Southern Soft No. 1	... ... 11 75
Hanging Rock Charcoal	... ... 17 00
ST. LOUIS:	
Southern Coke No 1	$ 9 50@$ 9 75
Southern Coke No. 2	9 00@ 9 25
Southern Coke No. 3	8 50@ 8 75
Southern Gray Forge	8 00@ 8 25
Southern Charcoal No. 1	... ... 13 00
Missouri Bessemer	... ... 19 00
Ohio Softeners	... ... 13 50
Lake Superior Car Wheel	... ... 14 50
Southern Car Wheel	... ... 14 50

OLD RAILS AND SCRAP METAL.

[Delivered Cleveland.]	GROSS TONS
Old iron rails	$14 00
Old steel rails (6 ft. and over)	10 50
Old steel rails (6 ft. and under)	10 00
Old car wheels	11 00
	NET TONS
No. 1 R. R. wrought scrap	$11 50
Mill scrap	8 50
No. 1 Machine cast scrap	8 00
Iron axles	15 00
Axle turnings	8 00
Wrought turnings (free from cast)	6 50
Cast borings	5 25
Uncut wrought iron boilers	3 50
Steel boiler plates	8 00
Grate bars	5 25
Pipes and flues (clean)	7 50
Tank iron	7 00
Hoop and band iron	6 50
Sheet iron	5 00
Wrought drillings	6 00
Malleable iron	8 50

STRUCTURAL MATERIAL.

Beams and Channels (f. o. b. Cleveland)	1.15c
Angles	1.15c
Tees	1.25c
Universal Plates	1.15@1.20c
Sheared Plates	1.20c

MERCHANT IRON AND STEEL.

[Less than car-lots, Cleveland.]

Rounds and Squares.—Bar Iron.

1 to 1½	1.10 Base.
2 to 2½	.20 extra.
3 to 3½	.50 "
3½ to 4	.80 "
4½ to 4½	1.00 "
4½ to 5	1.30 "
5½ to 6	1.80 "
6½ to 6½	2.20 "

6⅝ to 7¾	2.50 extra.
¾ to ⅞	.10 "
⅝ to 11-16	.20 "
½ to 9-16	.30 "
7-16 to 15-32	.40 "
⅜ to 13-32	.50 "
5-16 to 11-32	.70 "
¼ to 9-32	.90 "
7-32	1.40 "
3-16	2.50 "

Flats.—Bar Iron.

1⅛ to 4 x ⅜ to 1	1.05 Base.
4⅛ to 6 x ⅜ to 1	.10 extra
6⅛ to 8 x ⅜ to 1	.60 "
8⅛ to 10 x ⅜ to 1	.80 "
1⅜ to 4 x 1 1-16 to 1½	.30 "
4⅛ to 6 x 1 1-16 to 1½	.40 "
6⅛ to 8 x 1 1-16 to 1½	.60 "
8⅛ to 10 x 1 1-16 to 1½	.90 "
2 to 4 x 1⅝ to 2	.50 "
4⅛ to 6 x 1⅝ to 2	.60 "
6⅛ to 8 x 1⅝ to 2	.80 "
8⅛ to 10 x 1⅝ to 2	1.00 "
2 to 4 x 2⅛ to 3	.60 "
4⅛ to 6 x 2⅛ to 3	.80 "
6⅛ to 8 x 2⅛ to 3	1.00 "
1⅛ to 1⅜ x ⅜ to 1	.10 "
1 to 1 1-16 x ⅜ to ⅝	.20 "
¾ to 15-16 x ⅜ to ¾	.40 "
⅝ to 11-16 x ⅜ to ⅝	.50 "
½ to 9-16 x ⅜ to ⅝	.90 "

Heavy Band Iron.

7 to 10 x ¼ to 5-16	.70 extra.
6¼ to 6¾ x ¼ to 5-16	.50 "
4⅜ to 6 x ¼ to 5-16	.30 "
1⅜ to 4 x ¼ to 5-16	.20 "
1 to 1⅜ x ¼ to 5-16	.30 "
¾ to 15-16 x ¼ to 5-16	.50 "
⅝ to 11-16 x ¼ to 5-16	.80 "
⅜ to 9-16 x ¼ to 5-16	1.00 "
⅜ to 7-16 x ¼ to 5-16	1.50 "

Heavy bands, 7-32 in. thick 1-10 c. per lb. higher than ¼ to 5-16 thick. **Bevel Edge Shaft Iron** 1-10 higher than same size of Heavy Bands.

Light Band Iron.

7 to 8 x No 9 to 3-16	.90 extra.
7 to 8 x Nos. 10, 11 and 12	1.00 "
6¼ to 6¾ x No. 9 to 3-16	.70 "
6¼ to 6¾ x Nos. 10, 11 and 12	.80 "
4⅜ to 6 x No. 9 to 3-16	.50 "
4⅜ to 6 x Nos. 10, 11 and 12	.60 "
1⅜ to 4 x No. 9 to 3-16	.40 "
1⅜ to 4 x Nos. 10, 11 and 12	.50 "
1 to 1 3-16 x No. 9 to 3-16	.50 "
1 to 1 3-16 x Nos. 10, 11 and 12	.60 "
13-16 to ⅞ x No. 9 to 3-16	.60 "
13-16 to ⅞ x Nos. 10, 11 and 12	.70 "
11-16 to ¾ x No. 9 to 3-16	.80 "
11-16 to ¾ x Nos. 10 11 and 12	.90 "
9-16 to ⅝ x No. 9 to 3-16	1.00 "
9-16 to ⅝ x Nos 10, 11 and 12	1.10 "
7-16 to ½ x No 9 to 3-16	1 30 "
7-16 to ½ x Nos 10, 11 and 12	1 40 "
⅜ x No. 9 to 3-16	1.50
⅜ x Nos. 10, 11 and 12	1.60

Bevel Edge Box Iron.

Same as Light Bands, of same sizes.

Beaded Band Iron, 1¼ in. to 2 in.

Sand Band Iron, 1-10 c. above same sizes of Light Bands.

Oval Iron.

⅜ to 1½	.40 extra.
¼ to 13-16	.50 "
⅜ to 11-16	.60 "
½ to 9-16	.80 "
⅜ to 7-16	1.10 "
½ to 9-16 x 3-16	1.00 "
⅜ to 11-16 x ⅛	1.20 "

Half Oval and Half Round.

2¼ to 3	.60 extra.
⅜ to 2	.50 "
¾ to 13-16	.70 "
⅜ to 11-16	.90 "
½ to 9-16	1.20 "
⅜ to 7-16	2.50 "
5-16	3.50 "
¼	4.50 "

Half Ovals less than ¼ their width in thickness, extra price.

Horse Shoe Iron.

All sizes 1 c extra.

Cutting ordinary bars to specified length, .20 to .30 extra, according to length and size.

Steel Bands.

Width In Inches.	English Standard Gauge.		Extras.
1 1-2 to 6,	Nos. 7, 8, 9 or 3-16"	1.50	Base.
1⅝ to 6,	" 10, 11, 12 or ⅛"	.05	per 100 lbs.
1 to 1⅜,	" 7, 8, 9 or 3- 6"	.10	"
1 to 1⅜,	" 10, 11, 12 or ⅛"	.15	"
13-16 and ⅞,	" 7, 8, 9 or 3-16"	.20	"
13-16 and ⅞	" 10, 11, 12 or ⅛"	.25	"
11-16 and ¾,	" 7, 8, 9 or 3-16"	.30	"
11-16 and ¾,	" 10 11, 12 or ⅛"	.35	"
9-16 and ⅝,	" 7, 8, 9 or 3-16"	.40	"
9-16 and ⅝,	" 10 11, 12 or ⅛"	.45	"
½,	Nos. 7. 8. 9 or 3-16"	.55	"
½,	" 10, 11, 12 or ⅛"	.60	"
7-16	" 7, 8, 9 or 3-16"	.75	"
7-19	" 10, 11, 12 or ⅛"	.85	"
⅜,	" 7. 8, 9 or 3-16"	.95	"
⅜,	" 10, 11, 12 or ⅛"	1.05	"

Iron and Steel Hoops.

Width in Inches.	English Standard Gauge.		Extras
1 7-16 to 3	Nos. 13, 14, 15 and 16	1.60	Base.
1 7-16 to 2,	" 17, 18, and 19	.05	per 100 lbs.
1 7-16 to 2,	" 20	.10	"
1 7-16 to 2,	" 21	.15	"
1 7-16 to 1¾,	" 22	.25	"
1⅝ to 1¾,	" 13, 14 and 15	.05	"
1¾ to 1¾	" 16,17,and 18	.10	"

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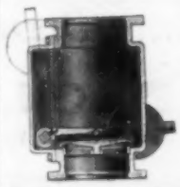

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This valve has no dash pots, springs, guides or complicated levers to get out of order. It is simple, reliable and well made. Never sticks, and can be relied upon at all times when using exhaust steam for heating; or when used as a relief, or free exhaust on a condensing plant, it has no equal. It is noiseless and free from any complicated attachments.

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NO HOLES DRILLED INTO IT
ALL PARTS CLAMPED ON.

Perfect Forward Dump.
Strongest, Easiest Handled.
Lightest and Most Durable.

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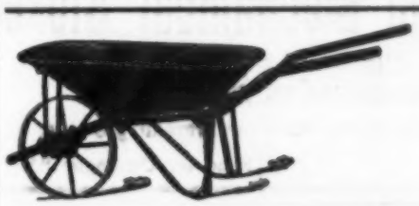
The Akron Cultivator Co.,
MANUFACTURERS, Akron, Ohio.



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CLEVELAND OHIO.

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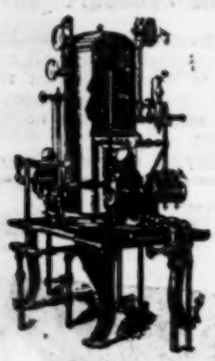

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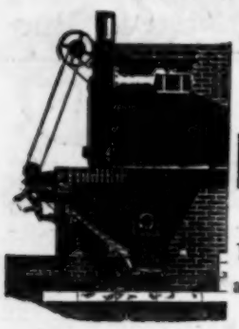

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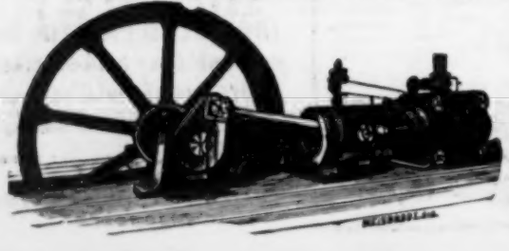

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Simple and Compound.

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1⅛ to 1⅜,	"	19 and 20	.15 per 100 lbs.
1⅛ to 1⅜,	"	21	.20 "
1⅛ to 1⅜,	"	22	.30 "
15-16 and 1,	"	13, 14 and 15	.10 "
15-16 and 1,	"	16, 17 and 18	.15 "
15-16 and 1,	"	19 and 20	.20 "
15-16 and 1,	"	21	.25 "
15-16 and 1,	"	22	.35 "
⅞, Nos. 13, 14 and 15			.20 "
⅞, " 16, 17 and 18			.25 "
⅞, " 19 and 20			.30 "
⅞, " 21			.35 "
⅞, " 22			.45 "
¾ and 13-16 Nos. 13, 14 and 15			.30 "
¾ and 13-16 " 16, 17 and 18			.35 "
¾ and 13-16 " 19 and 20			.40 "
¾ and 13-16 " 21			.45 "
¾ and 13-16 " 22			.50 "
¾ and 13-16 " 23			.60 "
11-16, Nos. 13, 14 and 15			.35 "
11-16, " 16, 17 and 18			.40 "
11-16, " 19 and 20			.50 "
11-16, " 21			.60 "
11-16, " 22			.70 "
11-16, " 23			.80 "
⅝, Nos. 13, 14 and 15			.40 "
⅝, " 16, 17 and 18			.45 "
⅝, " 19 and 20			.55 "
⅝, " 21			.65 "
⅝, " 22			.75 "
⅝, " 23			.85 "
9-16, " 13, 14 and 15			.45 "
9-16, " 16, 17 and 18			.50 "
9-16, " 19 and 20			.60 "
9-16, " 21			.70 "
9-16, " 22			.80 "
9-16, " 23			.90 "
½, " 13, 14 and 15			.55 "
½, " 16, 17 and 18			.60 "
½, " 19 and 20			.70 "
½, " 21			.80 "
½, " 22			.90 "
½, " 23			1.00 "
7-16, " 13, 14 and 15			.80 "
7-16, " 16, 17 and 18			.90 "
7-16, " 19 and 20			1.00 "
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⅜, " 16, 17 and 18			1.10 "
⅜, " 19 and 20			1.20 "

Sheet Iron.

No. 10	1 50
No. 12	1 70
No. 14	1 60
No. 15-17	1 75
No. 18	1 85
No. 20	2 00
No. 22-24	2
No. 25-26	2 20
No. 27	2 30

English Tool Steel.

Jessop's	15½c
Hobson's "Best"	15½c
" "Choice"	35c

Steel Boiler Plates—1-4 in. and Heavier.

Tank	1 35
Shell	1 45
Flange	1 55
Marine Flange	1 60
Fire Box	2 05

Above includes plates 90 inches wide.

90 to 96 in. wide	½c. lb. extra
96 to 100 in. wide	1c. "
100 to 104 in. wide	1½c. "
104 to 106 in. wide	special.

Flats.

	cts. lbs.
2 to 9-16 in. wide by 2 to ½ thick	.08

Bessemer and O. H. Steel.

Bessemer Machinery	base price,	1 40
Open-hearth Tire	"	1 45
Open-hearth Spring	"	1 80
Sleigh Shoe	"	1 45
Toe Calk	"	1 90
Cutter Shoes, tapered and bent	"	1 60

American Cast Tool Steel.

ROUND, SQUARE, AND OCTAGON.	cts lbs.
1 to 2 in. inclusive	.08
9-16 to ⅞ in. "	.08
7-16 to ⅜ and 2¾ to 3 in	.09
3¼ to 4 in	.09½
⅜ to 11-16 and 4½	.10
½ to 6 in	.10½
¾ to 9-32 and 6½ to 7 in	.11
1 in	.13

Burden Boiler Rivets.

⅛, ¼, 11-16 and ¾ inches diameter	3 co
Bridge ⅛, ¼, 11-16 and ¾ inch diam	2 55

Wrought Pipe and Boiler Tubes.

Lap weld black, base, and 10 per cent	.78
Butt " " " "	.72
Lap " galv. " "	.70
Butt " " " "	.67
Boiler tubes 2¼" and smaller	.72½
Boiler tubes 2½" and larger	.75
Casting screw and socket joint	dis. 50
Casing inserted joint	dis. 45

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No Name Metal, 18 cts. per lb., f. o. b. New York or Chicago.

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Anvils.

American	₩ lb 9@10
Wright's	₩ lb 12

Bellows.

Blacksmiths'	Hill's	dis 40
	Bullock's	dis 50&10
Moulders'		dis 40@40&10
Hand		dis 40&10@50

Rivets.

Iron, Thousand, list November 1, 1894.....dis 60@65
Iron, Ordinary, Cooper's Block and Carriage list November 1, 1894.....dis 60@65
Copper.....dis 50@50&10

Taps.

Cards, Hand and Nut to 2 in.....dis 50
Carpenters' " " " .....dis 50
Morse " " " .....dis 50
Pratt & Whitney " " new list.....dis 10
Machine Screw Taps.....dis 50
Pipe Taps to 2½ in.....dis 70
Stay Bolt Taps.....dis 25
Stove Bolt Taps.....dis 50
Pulley Taps.....dis 40

Vises.

Solid Box.....dis 60
Parker's.....dis 20@40
Prentiss.....dis 30
Stephen's.....dis 25@30
Barrett's.....dis 50
Miller's Falls.....dis 40
Merrill's.....dis 15@20
Howard.....dis 50

Wire.

New List, Apr. 9, 1894

Brass.....dis 35
Copper.....dis 35C
Bright and annealed, Nos. 0@18.....dis 70&10@75
" " Nos. 19@26.....dis 75@75&5
" " Nos. 27@36.....dis 75&10&5
Coppered Nos. 0 to 18, market list.....dis 70@70&5
Galvanized Nos. 0 to 18 " " .....dis65&5
Tinned market Nos. 0 to 18.....dis 67½
Cast steel.....dis 50
Tinned Broom Wire.....dis 70&5@70&10
Annealed Fence, Nos. 8 and 9.....dis 75
Annealed Grape, Nos. 10 to 14.....dis 75
Stub's Steel Wire regular.....95c ₰ lb dis 10

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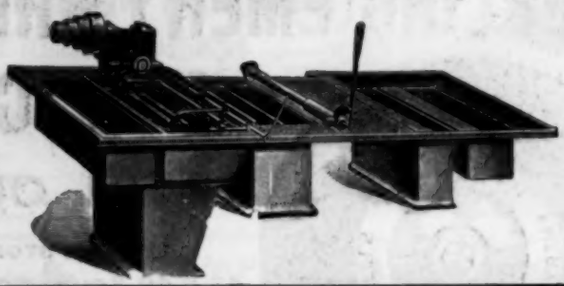
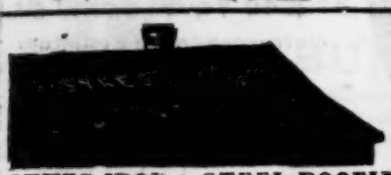


Rolling Mills, Sand and Chill ROLLS.



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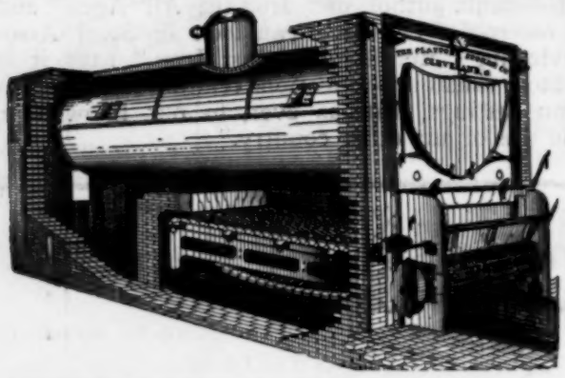

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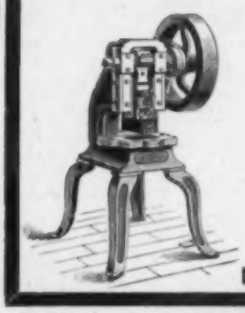

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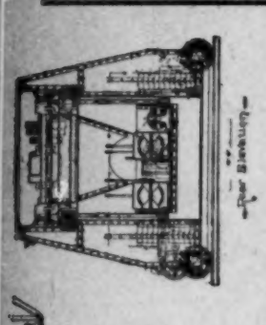

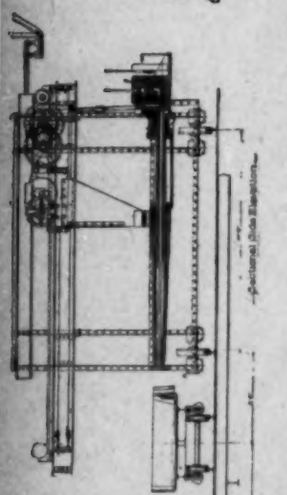

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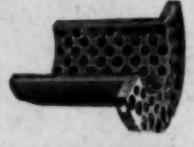

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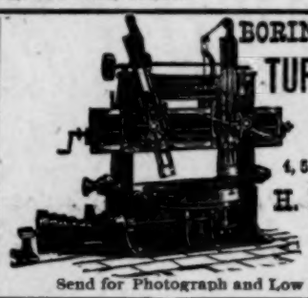

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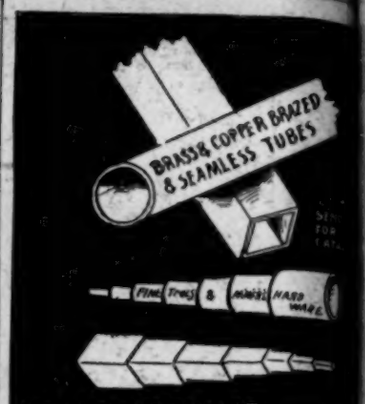

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